

REPORT



My Home Energy Report Program Evaluation

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1 Executive Summary

1.1 Program Summary

Duke Energy offers the My Home Energy Report (MyHER) to residential customers who live in single-metered, single family homes with thirteen months of usage history throughout Duke Energy's Carolinas service territory (DEC). MyHER relies on principles of behavioral science to encourage customer engagement with home energy management and energy efficiency. The program accomplishes this primarily by delivering a personalized report comparing each customer's energy use to a peer group of similar homes.¹ MyHER motivates customers to reduce their energy consumption by:

- Comparing their household electricity consumption to that of similar homes
- Suggesting tips for reducing energy use by changing customers' behavior or installing energy efficient equipment
- Educating them about the energy savings benefits of Duke Energy's demand side management (DSM) programs
- Encouraging active management of their home's energy consumption

1.2 Evaluation Objectives and High Level Findings

This report presents the result of Nexant's evaluation activities. Nexant estimated the annual energy impacts associated with MyHER and measured customer satisfaction and engagement for MyHER participants. The MyHER program operates as a randomized, controlled trial: customers are randomly assigned to either "treatment" or "control" for energy savings attribution purposes. Treatment customers are MyHER recipients or participants. The control group is a set of customers from whom the MyHER is intentionally withheld; the control group serves as the baseline against which MyHER impacts are measured. As Duke Energy customers become eligible for the MyHER program, Duke Energy randomly assigns them to one of these two groups.

The energy savings generated by the MyHER program are presented in Table 1-1. The evaluated energy savings for the MyHER program are net of additional energy savings achieved through increased participation by the MyHER treatment group in other Duke Energy programs. Additional information concerning the evaluation period is shown in Table 1-2.

¹ Homes are grouped by characteristics such as location, size, vintage, and heating fuel. Energy use is compared on groups of similar homes.

Table 1-1: Claimed and Evaluated Energy Impacts per Participating Household

	Energy (kWh)	Demand (kW)	Confidence/Precision
Claimed Impacts	183.7	0.0389	N/A
Evaluated Impacts	229.8	0.0581	90/6

*MyHER is an opt-out program. As such, all impacts are considered net impacts; nevertheless, Nexant calculated the impacts of the MyHER program by removing savings achieved by MyHER participants via other Duke Energy Programs.

Table 1-2: Sample Period Start and End Dates

Evaluation Component	Start	End
Impact Evaluation Period*	May 2015	April 2016
Customer Survey Period	June 2016	August 2016

*The MyHER impact analysis provides census estimates for the most recent twelve months prior to the analysis.

1.3 Evaluation Recommendations

The Carolinas MyHER program realized 125% of its claimed impacts during this evaluation period.

Duke Energy undertakes substantial planning and coordination to deliver MyHER to approximately 943,000 DEC customers in North Carolina and 290,000 DEC customers in South Carolina. Duke Energy has developed a production process with the MyHER implementation contractor (Tendril, Inc.) that allows Duke Energy to customize MyHER messages, tips, and promotions on the basis of customer information and exposure to Duke Energy's demand-side management programs. Both Duke Energy and Tendril staff described a rigorous quality control process that has been very successful in preventing lapses in report quality from reaching the customers. Areas for improvement to the program generally circle around opportunities to better support this process and manage risks to it. Appropriate staffing at Tendril to support the technical and data-centered ongoing quality control processes for report mailings is critical to success in this area. Additionally, increased adherence or better development of a data delivery schedule on Tendril's part to initiate the quality control process will improve Duke Energy's ability to conduct their checks in a timely and complete manner. The increased pace of report mailings represents a long chain of quality control tasks for Duke Energy; responsibility for completing these tasks rests with a relatively small staff. Without redundant staffing, Duke Energy should contemplate and manage risks to MyHER program operations presented by turnover or outages in availability of their staff, planned or otherwise.

Nexant recommends additional quality control and monitoring actions for enhancing Duke Energy Carolinas' MyHER program:

- **Maintain the integrity of the randomized, controlled trial (RCT) design with consistent, simultaneous assignment of newly-eligible customers to the treatment and control groups.** Nexant recommends that Duke Energy assign customers to either treatment or control when making cohort group assignments. Simultaneous cohort

assignment to treatment and control will eliminate any potential sources of bias stemming from time-dependent factors that could lead to observable or unobservable differences between the two groups.

- **Apply the randomized, controlled trial (RCT) design when considering program enhancements or changes.** The MyHER program is an excellent tool for customer engagement and communication; Duke Energy may use the MyHER program as a platform for testing different approaches to customer engagement, but Nexant recommends leveraging the reliability and insight provided by RCT approaches when evaluating the results of such test.
- **Continue to manage MyHER operations with an eye towards change management and prioritization of program changes.** Challenges in quality control have historically followed on the heels of program changes and enhancements. Introduce changes slowly to consistently maintain a product that meets quality control standards and results in report cycles that pass quality assurance checks the first time.
- **Prioritize appropriate project staffing.** With MyHER's long, demanding, and ongoing production process, resource availability of appropriate staff can have implications for product quality and timely delivery. Outages and risk of outages of key project resources should be closely managed.
- **Continue to monitor engagement and evaluate the impacts of the Interactive Portal:** However, for this evaluation period, the MyHER Interactive Portal savings estimates are too uncertain to determine whether the portal generates incremental savings above and beyond the standard MyHER paper edition. Although impact estimates are very uncertain, it would also be premature to draw the conclusion that MyHER Interactive is not working, and statistical models of monthly impact reflect some directional consistency.

2 Introduction and Program Description

This section presents a brief description of the My Home Energy Report (MyHER) program as it operated in the DEC service territory from May 2015 through April 2016. This description is informed by document review, in-depth interviews with staff, and Nexant's understanding of program nuance developed through regular communication during the evaluation process.

2.1 Program Description

The MyHER program is a Duke Energy Carolinas behavioral product for demand-side management (DSM) of energy consumption and generation capacity requirements. The MyHER presents a comparison of participants' energy use to a peer group of similar homes. It is sent by direct mail eight times a year. The MyHER provides customer-specific information that allows customers to compare their energy use for the month and over the past year to the consumption of similar homes and homes considered energy-efficient. Reports include seasonal and household-appropriate energy savings tips and information on energy efficiency programs offered by DEC. Many tips include low cost suggestions such as behavioral changes. Duke contracts with Tendril Inc. for the management and delivery of its MyHER product.

In March 2015, Duke Energy launched the MyHER Interactive Portal (MyHER Interactive, or Interactive). MyHER Interactive seeks to engage customers in a responsive energy information and education dialogue. When customers enroll in the online portal, they are given the opportunity to update and expand on information about their home and electricity consumption. Customers are also routinely sent energy management tips and conservation challenges via email. The general strategy of the MyHER Interactive Portal is to open communications between customers and the utility, as well as to explore new ways of engaging households in electricity consumption management.

Customers occupying single-family homes with an individual electric meter and at least thirteen months of electricity consumption history are eligible for MyHER. The program is an opt-out program: customers can notify Duke Energy if they no longer wish to receive a MyHER and will be subsequently removed from the program.

Duke Energy placed a portion of eligible customers into a control group to satisfy evaluation, measurement, and verification (EM&V) requirements. These control group customers are not eligible to participate in the MyHER program. Duke Energy reduced the size of the MyHER control group in September and October 2015. This release was done in conjunction with Duke Energy's desire to make the energy savings of MyHER more widely available to its customers and Nexant's observation that the control group size of the DEC MyHER program was much larger than is necessary to reliably estimate the energy savings attributable to Duke Energy's management and deployment of the MyHER program.

Duke Energy has several objectives for the MyHER program, including:

1. Generating cost effective energy savings
2. Increasing customer awareness of household energy use, engagement with Duke Energy, and overall customer satisfaction with services provided by Duke Energy
3. Promoting other energy efficiency program options to residential customers

2.2 Implementation

MyHER is implemented by Tendril Inc., an analytics contractor that prepares and mails the MyHER reports according to a pre-determined annual calendar. Tendril also generates and disseminates the MyHER Interactive Portal reports, emails, energy savings tips, and energy savings challenges. Tendril and Duke Energy coordinate closely on the data transfer and preparation required to successfully manage the MyHER program, and they make adjustments as needed to provide custom tips and messages expected to reflect the characteristics of specific homes. A more detailed discussion of the roles and responsibilities of both organizations appears in Section 4.

Eligibility

MyHER targets residential customers living in single family, single meter, and non-commercial homes with at least thirteen months of electricity consumption history. Approximately 1,100,000 DEC residential customers currently met these requirements as of April 2016. Accounts could still be excluded from the program for reasons such as the following: assignment to the control group, different mailing and service addresses, and enrollment in payment plans based on income (although budget bill customers are eligible). Eligibility criteria for the MyHER program have changed over time, and in some cases, customers were assigned to either treatment or control but later determined to be ineligible for the program. Nexant estimates that approximately 10.3% of assigned customers have been deemed ineligible for the program after having been assigned. Nexant addresses this topic by applying an intention-to-treat analysis (ITT); refer to section 3.1.2.

2.3 Key Research Objectives

The section describes key research objectives and associated evaluation activities.

2.3.1 Impact Evaluation Objectives

The primary objective of the impact evaluation is to describe the impact of the program on energy consumption (kWh). Savings attributable to the program are measured across an average annual and monthly time period. The following research questions guided impact evaluation activities:

1. Is the process used to select customers into treatment and control groups unbiased?
2. Are the sample sizes of control groups used by the various entities optimal and if not,

how should they be modified to be brought into line with reasonable precision targets (e.g., plus or minus 1% precision with 90% confidence).

3. What is the impact of MyHER on the uptake of other Duke Energy programs (downstream and upstream) in the market?
4. What net energy savings are attributable solely to MyHER reports after removing savings already claimed by other DEC energy efficiency programs?
5. What incremental savings are achieved by customers participating in the MyHER Interactive portal?

2.3.2 Process Evaluation Objectives

The program evaluation also seeks to identify improvements to the business processes of program delivery. Process evaluation activities focused on how the program is working and opportunities to make MyHER more effective. The following questions guided process data collection and evaluation activities:

1. Are there opportunities to make the program more efficient, more effective, or to increase participant engagement?
2. What components of the program are most effective and should be replicated or expanded?
3. What additional information, services, tips or other capabilities should MyHER consider?
4. Does MyHER participation increase customer awareness of their energy use and interest in saving energy?
5. To what extent does receiving MyHER increase customer engagement?
6. Do participants hold more favorable opinions of Duke Energy as a result of receiving the reports?
7. Do they express higher levels of stated intentions to save energy?
8. Are they more likely to say they will take advantage of Duke Energy's energy efficiency programs in the future?
9. What prevents households from acting upon information or tips provide by MyHER?
10. How can the program encourage additional action?

2.4 Organization of This Report

The remainder of this report contains the results of the impact analysis (Section 3); the results of the process evaluation activities, including the customer surveys (Section 4); and Nexant's conclusions and recommendations (Section 5).

3 Impact Evaluation

3.1 Methods

The MyHER impact evaluation measures the change in electricity consumption (kWh) resulting from exposure to the normative comparisons and conservation messages presented in Duke Energy's My Home Energy Reports. The approach for estimating MyHER impacts is built into the program delivery strategy. Eligible accounts are randomly assigned to either a treatment (participant) group or a control group. The control group accounts are not exposed to MyHER in order to provide the baseline for estimating savings attributable to the Home Energy Reports. In this randomized controlled trial (RCT) design, the only explanation for the observed differences in energy consumption between the treatment and control group is exposure to MyHER.

The impact estimate is based on monthly billing data and program participation data provided by Duke Energy. The RCT delivery method of the program removes the need for a net-to-gross analysis as the billing analysis directly estimates the net impact of the program. After estimating the total change in energy consumption in treatment group homes, Nexant performed an overlap analysis to quantify the savings associated with increased participation by treatment homes in other DEC energy efficiency offerings. These savings were claimed by other programs; therefore, they are subtracted from the MyHER impact estimates to eliminate double-counting.

3.1.1 Data Sources and Management

The MyHER impact evaluation relied on a large volume of participation and billing data from Duke Energy's data warehouse. Nexant provided a data request for the necessary information in April 2016. Key data elements include the following:

- **Participant List** – a table listing each of the homes assigned to the MyHER program since its inception in 2010. This table also indicated whether the account was in the treatment or control group and the date the home was assigned to either group. Duke Energy also provided a supplemental table of Experian demographic data for program participants.
- **Billing History** – a monthly consumption (kWh) history for each account in the treatment and control group. Records included all months since assignment as well as the pre-assignment usage history required for eligibility. This file also included the meter read date and the number of days in each billing cycle.
- **MyHER Report History** – a record of the approximate 'drop date' of each MyHER report sent to the treatment group accounts, the messaging included, and the recommended actions. This dataset also contained a supplemental table of treatment group accounts omitted from each MyHER mailing in 2015 and 2016, and the associated reason for omission.

- **Participation Tracking Data for Other DEC Energy Efficiency Programs** – a table of the Duke Energy DSM program participation of MyHER control and treatment group accounts. Key fields for analysis include the measure name, quantity, participation date, and net annual kWh and peak demand impacts per unit for each MyHER recipient and control group account participating in other DSM programs offered by Duke Energy.
- **MyHER Interactive Session Data** – a dataset containing information on participants' date of enrollment, the date of each login (e.g. a single MyHER Interactive portal session), and the duration of the session.

In preparation for the impact analysis, Nexant combined and cleaned the participation and billing data provided by the MyHER program staff. The participant list dataset included an average of 1,354,244 distinct accounts (the actual number varies by month); 1,233,115 accounts were assigned to the treatment group and 121,129 accounts assigned to the control group.

Nexant removed the following accounts and data points from the analysis:

- 1,149 records (<0.08%) where the number of days in the billing cycle was equal to zero
- 27 records with a negative value for billed kWh
- 497 records with unrealistically high usage: any month with greater than six times the 99th percentile value for daily kWh usage, or approximately 900 kWh per day
- 62 records having a meter read date more than 100 days before or after the 15th of the bill month to which the usage was assigned

Like most electric utilities, Duke Energy does not bill its customers for usage within a standard calendar month interval. Instead, billing cycles are a function of meter read dates that vary across accounts. Duke Energy “calendarizes” billing records in its data warehouse in a field called “bill month.” A record with bill month equal to “201501,” for example, corresponds to the year and number of the bill—in this case, the home’s first bill for 2015. Typically this will reflect energy captured by a meter read during one of the approximately 20 weekdays in a given month. In this example, the electric usage associated with bill month 201501 would include a mix of December and January days depending on the meter read schedule of the account.

Nexant’s analysis of MyHER impacts is based on the meter read date. Nexant estimates MyHER impacts by examining differences in average daily consumption in each month, and by comparing consumption of control group customers to treatment customers. Nexant therefore estimates average daily consumption by calendar month to ensure customers’ billed consumption is compared on similar days under similar weather conditions. It is important to remember that monthly impact estimates presented in this report are based on calendar month, not the Duke Energy billing month.

3.1.2 Intention to Treat

Duke Energy maintains a number of eligibility requirements for continued receipt of MyHER. Not all accounts assigned to treatment remained eligible and received MyHER over the study horizon. Several programmatic considerations can prevent a treatment group home from receiving MyHER in a given month. Common reasons for an account not being mailed include the following:

- **Mailing Address Issues** – mailing addresses are subjected to deliverability verification by the printer. If an account fails this check due to an invalid street name, PO Box or other issue, the home will not receive the MyHER mailer.
- **Implausible Bill** – if a home's billed usage for the previous month is less than 150 kWh or greater than 10,000 kWh, Tendril does not mail the MyHER.
- **Insufficient Matching Households** – this filter is referred to as “Small Neighborhood” by Tendril and is a function of the clustering algorithm Tendril uses to produce the usage comparison. If a home can't be clustered with a sufficient number of other homes, it will not receive the MyHER mailer.
- **No Bill Received** – if Tendril does not receive usage data for an account from Duke Energy within the necessary time frame to print and mail, the home will not receive MyHER for the month.

The Nexant data cleaning steps listed in Section 3.1.1 do not impose these filters on the impact evaluation analysis dataset. This is necessary to preserve the RCT design because eligibility filters are not applied to the control group in the same manner as the treatment group. Nexant consequently employed an “intention-to-treat” (ITT) analysis. In the ITT framework, the average energy savings per home *assigned* to the treatment is calculated via billing analysis. This impact estimate is then divided by the proportion of the treatment group homes analyzed that were active MyHER participants. The underlying assumption of this approach is all of the observed energy savings are being generated by the participating accounts.

Nexant relied on Duke Energy's monthly participation counts for the numerator of the proportion treated calculation. MyHER program staff calculate participation monthly according to the business rules and eligibility criteria in place at the time. Access to additional data such as pending disconnects and other operational data prevented Nexant from replicating monthly participation totals identically. The denominator of the proportion treated is the number of treatment group homes with electricity consumption for the month. This calculation is presented by month in Table 3-1 for the study period. The average proportion of assigned accounts that were treated was 89.7%

Table 3-1: Calculation of Treatment Percentage by Bill Month

Bill Month	Number of Treatment Homes Analyzed	DEC Participant Count	Proportion of Homes Treated
201505	1,237,495	1,044,200	84.4%
201506	1,243,446	1,027,432	82.6%
201507	1,245,920	1,057,508	84.9%
201508	1,247,841	1,065,154	85.4%
201509	1,236,403	1,062,208	85.9%
201510	1,224,580	1,062,192	86.7%
201511	1,214,468	1,157,054	95.3%
201512	1,242,769	1,153,632	92.8%
201601	1,238,733	1,172,987	94.7%
201602	1,230,148	1,158,474	94.2%
201603	1,222,422	1,158,535	94.8%
201604	1,213,159	1,150,783	94.9%
Twelve Month Average Proportion			89.7%

The monthly participation counts shown in Table 3-1 were also used by Nexant to estimate the aggregate impacts of the MyHER. Per-home kWh savings estimates for each bill month are multiplied by the number of participating homes to arrive at the aggregate MWh impact achieved by the program.

3.1.3 Sampling Plan and Precision of Findings

The MyHER program was implemented as an RCT in which individuals were randomly assigned to a treatment (participant) group and a control group for the purpose of estimating changes in energy use because of the program. Nexant's analysis methodology relies on a census analysis of the homes in both groups so the resulting impact estimates are free of sampling error. However, there is inherent uncertainty associated with the impact estimates because random assignment produces a statistical chance that the control group consumption would not vary in perfect harmony with the treatment group, even in the absence of MyHER exposure. The uncertainty associated with random assignment is a function of the size of the treatment and control groups, as well as the underlying properties of customers' electricity consumption patterns. As group size increases, the uncertainty introduced by randomization decreases, and the precision of the estimates improves.

Nexant's MyHER impact estimates are presented with both an absolute precision and relative precision. Absolute precision estimates are expressed in units of annual energy consumption (kWh) or as a percentage of annual average consumption. The two following statements about the MyHER Carolinas impact analysis reflect absolute precision:

- MyHER saves an average of 229.8 kWh per home, \pm 15 kWh.

- Homes in the MyHER treatment group reduced electric consumption by an average of 1.6%, $\pm 0.05\%$.

In these examples the uncertainty of the estimate, or margin of error (denoted by “ \pm ”), is presented in the same absolute terms as the impact estimate—that is, in terms of annual electricity consumption. Nexant also includes the relative precision of the findings. Relative precision expresses the margin of error as a percentage of the impact estimate itself. Consider the following example:

- The average treatment effect of MyHER is 229.8 kWh with a relative precision of $\pm 6.5\%$. In this case $\pm 6.5\%$ is determined by dividing the absolute margin of error by the impact estimate: $15 \div 229.8 = 0.065 = 6.5\%$.

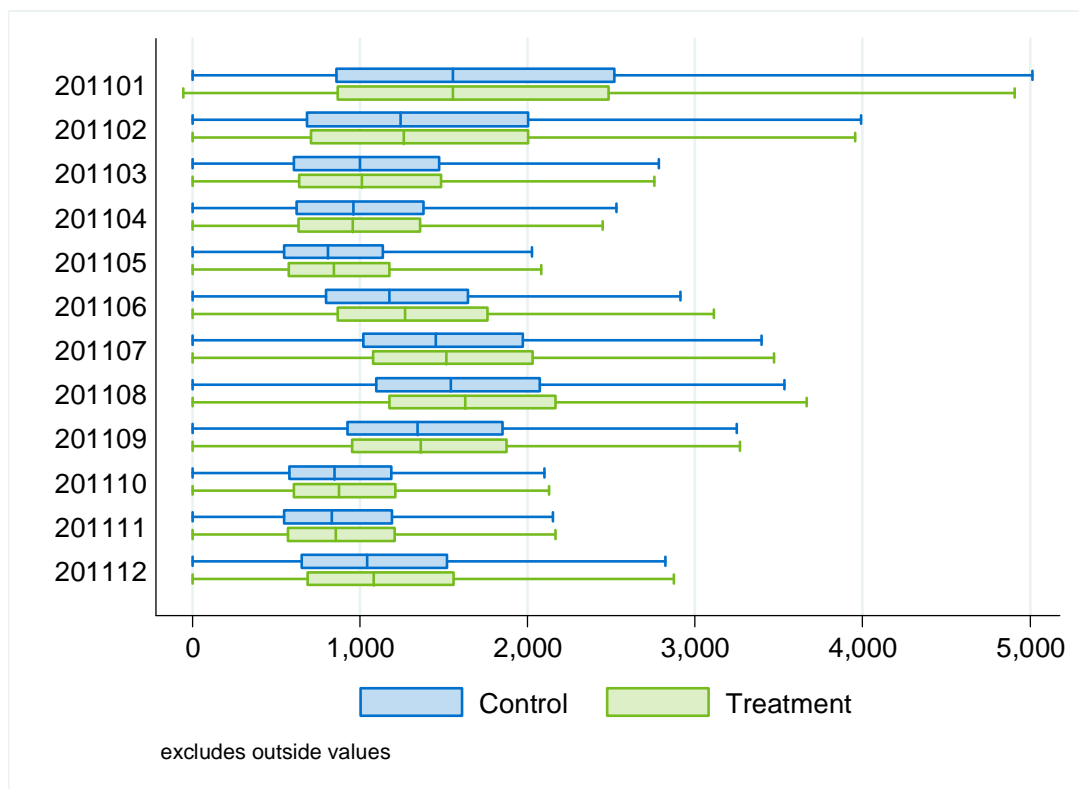
All of the precision estimates in this report are presented at the 90% confidence level and assume a two-tailed distribution.

3.1.4 Equivalence Testing

Straightforward impact estimates are a fundamental property of the RCT design. Random assignment to treatment and control produces a situation in which the treatment and control groups are statistically identical on all dimensions prior to the onset of treatment; the only difference between the treatment and control groups is exposure to MyHER. The impact is therefore simply the difference in average electricity consumption between the two groups. The first step to assessing the impact of an experiment involving a RCT is to determine whether or not the randomization worked as planned.

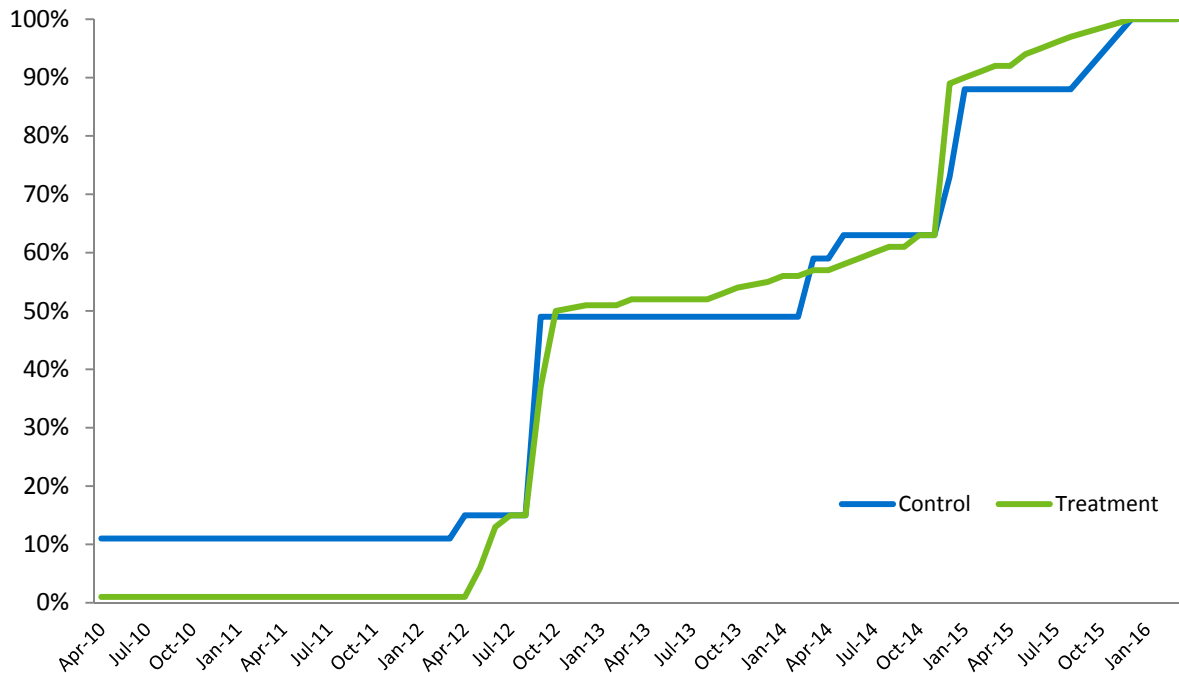
Figure 3-1 is a box-and-whisker plot of the average pre-treatment consumption for the treatment and control groups. The figure depicts the distribution of monthly average consumption in 2011, the time period prior to the full launch of the DEC MyHER program. This figure contains all accounts assigned to treatment and control in 2012 through 2013. While multiple instances of random assignment occurred over this period, Nexant aggregated DEC MyHER customers into annual or biannual cohorts because of the large number of individual assignment occasions. This figure shows some small differences in pre-treatment consumption between the treatment and control group customers. Some of these differences are due to the fact that Figure 3-1 is comprised of multiple instances of customer assignment to treatment or control; nevertheless, Nexant found differences in pre-treatment consumption across many individual occasions of random assignment within this time period. These pre-treatment differences and existence of multiple cohorts led Nexant to select the fixed-effects regression approach, which can appropriately control for such pre-treatment differences in the treatment and control groups.

Figure 3-1: Difference in Average Pre-treatment Billed Consumption for cohorts assigned in 2012 - 2013 (2011 kWh)



The DEC MyHER program consists of several assignment cohorts: the original pilot cohort from 2010, the full program launch in 2012 through 2013 with the selection of Tendril Inc. as the MyHER implementation contractor, and an expansion in 2014 through 2015. Since 2012, the program expanded as newer customers met the program's eligibility criteria. Figure 3-2 shows the timeline of program expansion since 2010 and the assignment history of customers in the treatment and control groups.

Figure 3-2: History of Cohort Assignments for DEC MyHER Program



This figure indicates customers were assigned to treatment and control on an alternating basis after the August 2012 program launch. In 2016, Nexant advised Duke Energy to maintain a simultaneous assignment protocol and to make assignment on an annual or biennial basis. Doing so will minimize any potential sources of bias that could occur due to a lack of simultaneous assignment to treatment and control. While assignments to treatment and control made at any single point in time after 2012 were random, the disproportionate assignment of customers to one group or the other for each instance of assignment resulted in differences in consumption patterns between the treatment and control groups over this time period. Nexant has accounted for these differences in its impact estimation approach.

Nexant estimated MyHER impacts by cohort using a fixed-effects panel regression model. A cohort is a group of accounts that are added to the program at a given time. Nexant mapped the MyHER population into four cohorts that generally follow the major periods when customers were assigned to treatment and control groups. Figure 3-3 indicates the composition of the current program by cohort.

Figure 3-3: Comparison of Treatment and Control Group Composition by Cohort

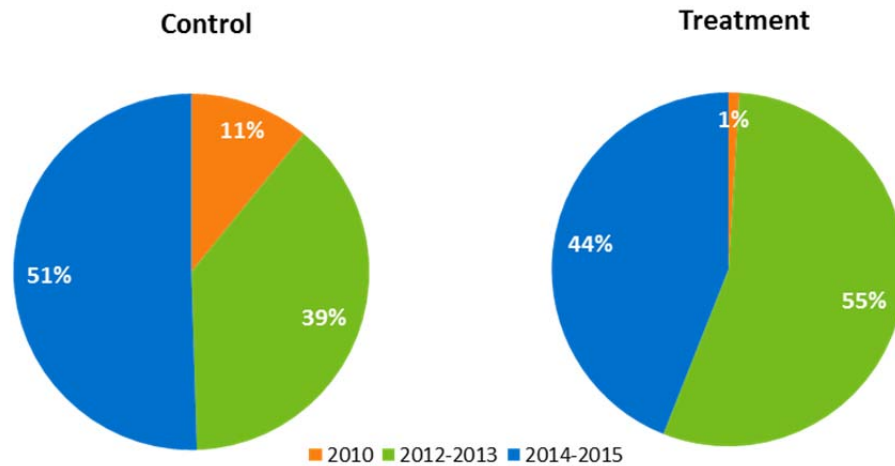


Table 3-2 provides additional summary information for each of the three cohorts. Note that the values presented in Table 3-2 are based on the year prior to each cohort's assignment; the customer counts do not match the current program composition presented in Figure 3-3 because they are measured at different points in time (prior to treatment and in April 2016, respectively). The "number of homes" columns reflect the number of active assigned customers without any filters applied for eligibility. Table 3-2 also compares the average annual kWh usage of each cohort's treatment and control group for the 12 months prior to the beginning of assignment. The pre-assignment usage is relatively balanced between groups for cohorts 1, 2, and 3.

Table 3-2: MyHER Cohort Summary Statistics

Cohort Number	Cohort Description	# Treatment Homes	# Control Homes	Annual kWh Pre-Assignment for Control Group	Annual kWh Pre-Assignment for Treatment Group	Pre-Period
1	2010	6,329	9,908	17,374	17,363	May-09 to Apr-10
2	2012-2013	571,443	33,886	14,521	14,958	Mar-11 to Feb-12
3	2014-2015	342,439	34,806	15,595	14,067	Feb-13 to Jan-14

3.1.5 Regression Analysis

Separating the MyHER population into cohorts accounts for cohort maturation effects and improves statistical precision relative to differences among the cohorts. Nevertheless, there are still some underlying differences between the cohort treatment and control groups that need to be netted out via a difference-in-differences approach. Nexant applied a linear fixed effects regression (LFER) model to each month in the evaluation period to account for these disparities.

The basic form of the LFER model is shown in Equation 3-1; the average treatment effect (ATE) is the sum of the monthly impact estimates from each monthly LFER model. Average daily electricity consumption for treatment and control group customers is modeled using an indicator variable for the billing period of the study, a treatment indicator variable, and a customer-specific intercept term:

Equation 3-1: Fixed Effects Model Specification

$$kWh_{it} = customer_i * \beta_i + I_t * \beta_t + I_t * \tau_t * treatment_{it} + \varepsilon_{it}$$

$$ATE = \sum_{t=1}^{12} \tau_t$$

Table 3-3 provides additional information about the terms and coefficients in Equation 3-1.

Table 3-3: Fixed Effects Regression Model Definition of Terms

Variable	Definition
kWh_{it}	Average daily electricity consumption for customer i in billing month t .
$customer_i$	An indicator variable that equals one for customer i and zero otherwise. This variable models each customer's average energy use separately.
β_i	The coefficient on the customer indicator variable. Equal to the mean daily energy use for each customer.
I_t	An indicator variable equal to one for each monthly billing period t , and zero otherwise.
β_t	The coefficient on the billing period t , indicator variable. This term measures each billing period's deviation from the customer's average energy use in the same month of previous years.
$treatment_{it}$	The treatment variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ_t	The estimated treatment effect in kWh per day per customer in billing month t ; the main parameter of interest.
ε_{it}	The error term.

Nexant estimated the LFER model separately for each of the three cohorts and each billing month. Detailed regression output can be found in Appendix E. The model specification includes an interaction term between the treatment indicator variable and the indicator variable for the bill month term. This specification generates a separate estimate of the MyHER daily impact for each bill month. Table 3-4 illustrates the calculation of monthly impact estimates from the regression model coefficients for homes assigned to treatment in the original MyHER pilot. Each month's average treatment effect is multiplied by an assumed number of days in the month equal to $365.25/12 = 30.4375$.

Table 3-4: Impact Calculation Example – Cohort 3

Bill Month	Daily Treatment Coefficient (τ)	Monthly Impact (kWh)
201505	-1.00988	-11.9
201506	-0.81431	-9.9
201507	-1.05961	-13.1
201508	-0.93664	-11.8
201509	-1.87292	-23.7
201510	-1.11843	-14.1
201511	-0.90031	-11.3
201512	-0.73122	-9.4
201601	-0.39896	-5.3
201602	-0.43122	-5.7
201603	-0.54891	-7.2
201604	-0.64927	-8.8
12 Month Total Impact		-132

Impact estimates from the three cohorts were weighted and combined for each month to calculate a weighted average treatment effect. The weighting factor was the number of homes with billing data that had been assigned to the treatment group during a prior month (e.g. were in the post-treatment period). These estimates of the average MyHER impact per assigned home were then divided by the proportion of customers treated, as shown in Table 3-1, to estimate the average treatment effect per participating home.

3.1.6 Dual Participation Analysis

The regression model outputs and subsequent intention-to-treat adjustments discussed in Section 3.1.5 produce estimates of the total change in electricity consumption in homes exposed to MyHER. Some portion of the savings estimated by the regression is attributable to the propensity of MyHER treatment group homes to participate in other DEC energy efficiency offerings at a greater rate than control group homes. The primary purpose of the dual participation analysis is to quantify annual electricity savings attributable to this incremental DSM participation and subtract it from the MyHER impact estimates. This downward adjustment prevents savings from being double-counted by both the MyHER program and the program where savings were originally claimed.

A secondary objective of the dual participation analysis is to better understand the increased DSM participation, or “uplift” triggered by inclusion of marketing messages within MyHER. The ability to serve as a marketing tool for other DSM initiatives is an important part of what makes MyHER attractive as Duke Energy assumes the role of a trusted energy advisor with its customer base.

Duke Energy EM&V staff provided Nexant with a table of non-MyHER program participation records for the MyHER treatment and control group homes dating back to January 2010. This dataset included nearly 4,330,000 records of efficient measure installations by the MyHER treatment and control group and formed the basis of Nexant's dual participation analysis. Table 3-5 shows the distribution of participation and savings during the MyHER evaluation period across Duke Energy's residential portfolio.

Table 3-5: EE Program Participation by MyHER Customers

Filed Program Name	Number of Records	Net MWh/year	Net kW/year
Smart Saver Residential	342,306	29,023	6,358
Appliance Recycling Program	6,513	3,804	506
Total	348,819	32,827	6,864

The MyHER dual participation analysis included the following steps:

- Match the data to the treatment and control homes by Account ID
- Assign each transaction to a bill month based on the participation date field in the tracking data
- Exclude any installations that occurred prior to the home being assigned to the treatment or control group
- Calculate the daily net energy savings for each efficiency measure
- Sum the daily net energy impact by Account ID for measures installed prior to each bill month
- Calculate the average savings per day for the treatment and control groups by bill month. This calculation is performed separately for each cohort
- Calculate the incremental daily energy saved from energy efficiency (treatment – control) and multiply by the average number of days per bill month (30.4375)
- Take a weighted average across cohorts of the incremental energy savings observed in the treatment group
- Subtract this value from the LFER estimates of treatment effect for each bill month

While the incremental participation rate of the treatment group in other EE programs is modest when considered in total, increased uptake of measures immediately following promotional messaging within MyHER mailers can be much more dramatic. Each MyHER issued has space for one product promotion message that is used to market other Duke Energy programs or initiatives. Duke provided Nexant with records of the exact messages received by each home. Table 3-6 shows the number of homes that received each combination of messages for nine MyHER cycles.

Table 3-6: MyHER Promotional Messaging by Month

Source Month	Message 1	Message 2	Number of Homes
1-Jan-14	Power Manager	Electric Blanket	637,586
1-Jan-14	Videos	Electric Blanket	81,259
1-Mar-14	Low Flow Toilet	811	68
1-Mar-14	Tune Up	811	716,723
1-May-14	Giving Back	Dryer Lint	15,621
1-May-14	HEHC	Dryer Lint	693,313
1-Jun-14	Smart Saver	Grill	679,685
1-Jun-14	Water Heater	Grill	20,245
1-Jul-14	Lighting Store	Wash	719,553
1-Jul-14	SS Ins & Seal	Wash	21,589
1-Aug-14	ARP	Calculator	154
1-Aug-14	SS Ins & Seal	Calculator	723,037
1-Oct-14	Share Warmth	Thank you	728,874
1-Dec-14	HEHC	Doors & Windows	813,415
1-Dec-14	Smart Saver	Doors & Windows	21,340
1-Jan-15	ARP	Water Heater Blanket	921,491
1-Jan-15	SS	Water Heater Blanket	11,306
1-Feb-15	SS HVAC	Replace Windows	206,282
1-Mar-15	Pool Pump	Earth Day	68,634
1-Mar-15	Store	Earth Day	959,454
1-May-15	Interactive	Heart	1,028,106
1-Jun-15	Keep Cool	811	37,210
1-Jun-15	SS	HVAC	998,042
1-Jul-15	SS Ins & Seal	Plant Trees	1,042,112
1-Aug-15	HEHC	Tailgating	219,032
1-Aug-15	School	Tailgating	826,298
1-Oct-15	Green	Interactive	1,134,248
1-Oct-15	PayGo	Interactive	3,040
1-Dec-15	Close Curtains	Share The Warmth	130,714
1-Dec-15	HEHC	Share The Warmth	268,423
1-Dec-15	High Bill Alerts	Share The Warmth	759,262
1-Jan-16	Bulbs Online Store	Water Heater Temp	1,152,678
1-Mar-16	EPP	Crawlspace	321,998
1-Mar-16	PM	Crawlspace	796,598

3.2 Impact Findings

3.2.1 Per-Home kWh and Percent Impacts

Nexant estimates the average participating MyHER home saved 229.8 kWh of electricity from May 2015 to April 2016. This represents a 1.6 percent reduction in total electricity consumption, compared to the control group over the same period. These final estimates reflect an upward adjustment to account for the intention-to-treat methodology and a downward adjustment to prevent double-counting of savings attributable to incremental participation of treatment groups in Duke Energy's energy efficiency programs.

Table 3-7 shows the impact estimates in each bill month for the average home assigned to treatment. The table also shows the subsequent adjustment to account for the fact that only a subset of homes assigned to treatment was actively participating in MyHER during the study period.

Table 3-7: MyHER Impact Estimates with ITT Adjustment

Month	Treatment Homes Analyzed	DEC Participant Count	kWh impact in Assigned Homes	% Treated	kWh Impact in Treated Homes
201505	1,237,495	1,044,200	-11.94	84.4%	-13.80
201506	1,243,446	1,027,432	-15.49	82.6%	-18.18
201507	1,245,920	1,057,508	-24.28	84.9%	-27.96
201508	1,247,841	1,065,154	-24.57	85.4%	-28.17
201509	1,236,403	1,062,208	-33.22	85.9%	-37.89
201510	1,224,580	1,062,192	-17.13	86.7%	-19.40
201511	1,214,468	1,157,054	-19.44	95.3%	-20.36
201512	1,242,769	1,153,632	-9.70	92.8%	-10.40
201601	1,238,733	1,172,987	-7.81	94.7%	-8.22
201602	1,230,148	1,158,474	-13.01	94.2%	-13.77
201603	1,222,422	1,158,535	-13.05	94.8%	-13.73
201604	1,213,159	1,150,783	-20.67	94.9%	-21.74
12-Month Total			-210	89.7%	-234

An adjustment factor of 4.19 annual kWh per home is applied to MyHER impact estimate estimates in Table 3-7 to arrive at the final net verified program impact per home. Section 3.2.6 provides additional detail on the calculation of the 4.19 kWh adjustment for overlapping participation in other Duke EE programs.

Table 3-8: MyHER Impact Estimates with Adjustment for Dual Participation

kWh Savings in Treated Homes	Incremental kWh from EE Programs	Net MyHER Impact Estimate	Control Group Usage (kWh)	Percent Reduction
234	-4.19	229.8	14,287	1.6%

The filed per-home impact for MyHER in DEC is 183.7 kWh per home based on a previous evaluation study. The Nexant evaluation results amounts to a realization rate of 125%.

3.2.2 Aggregate Impacts

The total impact of the MyHER program in the DEC service territory is calculated by multiplying the per-home impacts (adjusted for ITT and incremental EE participation) for each bill month by the number of participating homes. Over the twelve month period examined by Nexant in this evaluation, MyHER participants conserved 251.2 GWh of electricity; or enough energy to power nearly 17,257 homes for an entire year. The aggregate impacts presented in Table 3-9 are at the meter level so they do not reflect line losses which occur during transmission and distribution between the generator and end-use customer.

Table 3-9: MyHER Aggregate Energy Impacts

Month	DEC Participant Count	Per Home kWh Savings	Aggregate GWh
201505	1,044,200	13.64	14.2
201506	1,027,432	18.45	19.0
201507	1,057,508	27.76	29.4
201508	1,065,154	28.16	30.0
201509	1,062,208	37.86	40.2
201510	1,062,192	19.33	20.5
201511	1,157,054	20.28	23.5
201512	1,153,632	9.98	11.5
201601	1,172,987	7.46	8.7
201602	1,158,474	12.98	15.0
201603	1,158,535	12.90	14.9
201604	1,150,783	21.02	24.2
12-Month Total		229.8	251.2

3.2.3 Precision of Findings

The margin of error of the per-home impact estimate is ± 15 kWh at the 90% confidence interval. Nexant clustered the variation of the LFER model by Account ID to produce a robust estimate of the standard error associated with treatment coefficients. The standard normal z-statistic for the 90% confidence level of 1.645 was then used to estimate the uncertainty associated with each cohort estimate. This uncertainty was then aggregated across cohorts to quantify the precision of the program-level impacts estimates (Table 3-10).

Table 3-10: 90% Confidence Intervals Associated with MyHER Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Annual Savings per Home	215.0 kWh	229.8 kWh	244.6 kWh
Percent Reduction	1.50%	1.60%	1.70%
Aggregate Impact	235.0 GWh	251.2 GWh	297.4 GWh

The absolute precision of the result is $\pm 0.05\%$ and the relative precision of $\pm 6.4\%$ at the 90% confidence level.

3.2.4 Impact Estimates by Cohort

The per-home impact estimates shown in Table 3-7 reflect a weighted average impact across the three cohorts of MyHER customers analyzed. The impact estimates for the individual cohorts varied significantly for the study period. Table 3-11 shows point estimates for each cohort for the period May 2015 to April 2016.

Table 3-11: Annual kWh Impact Estimates by Cohort

Month	Cohort Impacts (kWh)		
	Cohort 1	Cohort 2	Cohort 3
201505	-13	0	-31
201506	-11	-9	-25
201507	-6	-19	-32
201508	-9	-22	-29
201509	-13	-16	-57
201510	-14	-5	-34
201511	-17	-14	-27
201512	-15	0	-22
201601	-22	-4	-12
201602	-13	-13	-13
201603	-14	-10	-17
201604	-6	-22	-20
Total	-153	-135	-319

Cohorts 1 and 3 show the largest average impact during the study period. Table 3-12 shows the margin of error at the 90% confidence level for each cohort's annual impact estimate. The combined margin of error for the entire program is lower than the error for any single cohort because the combined program impact estimate is based on a larger pool of customers. Individual cohort margins of error are high for the small cohorts due to the sizes of these groups relative to the underlying variation in consumption among the treatment and control groups constituting each cohort.

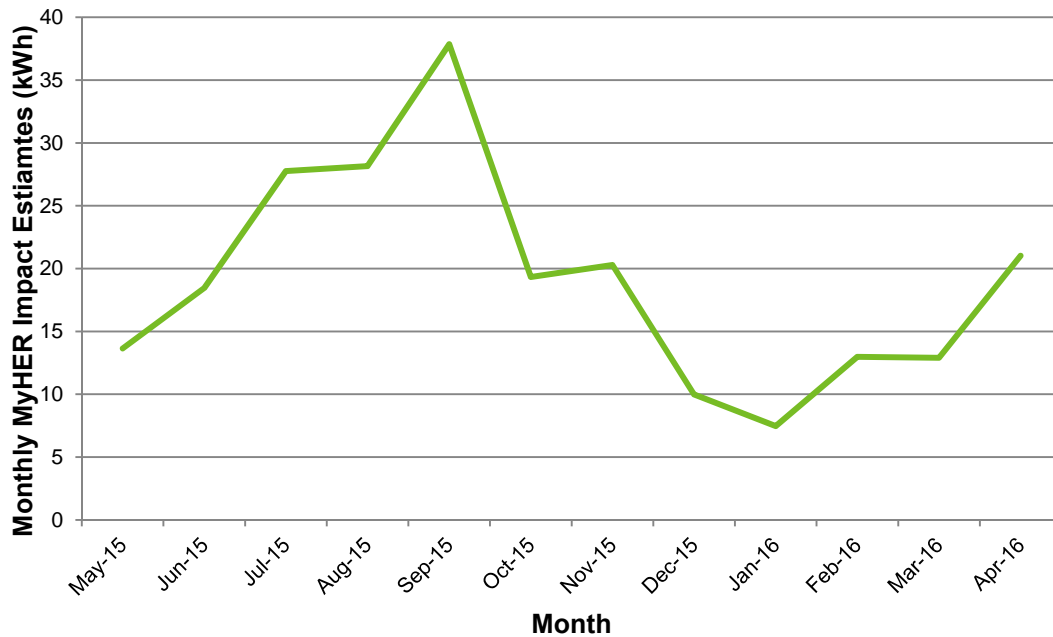
Table 3-12: 90% Confidence Intervals Associated with Cohort Estimates

Cohort Number	Cohort Description	Margin of Error in kWh at 90% Confidence Level
1	2010	± 1
2	2012-2013	± 25
3	2014-2015	± 60

3.2.5 Temporal Patterns

Duke Energy currently mails MyHER to the treatment group eight times per year. These mailers target the summer and winter months and skip the shoulder months. The green series in Figure 3-4 shows the average estimated monthly treatment effect for Cohort 1 (Pilot) in each month from May 2015 to April 2016. There is a definite seasonal pattern to the MyHER savings profile, with the largest impacts occurring during summer months and the smallest impacts occurring during winter months.

Figure 3-4: Average kWh Savings by Month, Pilot Cohort



Based on the observed savings trends, MyHER is actually performing quite well during shoulder months when Tendril does not mail reports. The treatment effect is still relatively strong at approximately 20 kWh per home each month. If Duke Energy wishes to explore the effect of changing the frequency or timing of MyHER delivery, Nexant recommends an experimental design where a portion of the treatment group is randomly selected for an alternative schedule while keep the remaining homes on the current delivery schedule.

Seasonal trends in MyHER average treatment effects likely reflect customers' differing abilities to respond by season. Customers' summer and winter savings may be higher than shoulder, which is due to the fact that there are more opportunities to conserve energy relative to baseline demands for energy in each season. Winter demands can be mitigated by dressing more warmly, using more blankets in the home, or shutting off lights more often (due to fewer daylight hours in the winter). The summer impacts can occur because small changes to thermostat set points can have a greater impact on hot days than on comparatively milder summer days.

3.2.6 Uplift in Other Programs

Section 3.1.6 outlined the methodology Nexant used to calculate the annual kWh savings attributable to increased participation in other DEC programs, a downward adjustment of 4.19 kWh per home, or 5.17 GWh in aggregate, as shown in Table 3-13.

Table 3-13: Monthly Adjustment for Overlapping Participation in Other EE Programs

Bill Month	Incremental kWh from Other EE Programs
201505	0.16
201506	0.13
201507	0.19
201508	0.00
201509	0.03
201510	0.08
201511	0.07
201512	0.42
201601	0.76
201602	0.78
201603	0.84
201604	0.72
Incremental kWh from EE netted out of MyHER	4.19

Although these additional savings must be subtracted from the MyHER effect to prevent double-counting, the MyHER promotional messaging clearly played an important role in harvesting these savings.

Table 3-14 shows the average daily energy savings attributable to tracked energy efficiency measures as of April 2016 by cohort and calculates an uplift percentage. In each case the treatment group showed a higher propensity to adopt measures through DEC programs than the control group. Nexant only counted savings for measures installed in the “post” period so the cohorts that have been assigned to MyHER for the longest period of time have accumulated the most savings.

Table 3-14: Uplift Percentage by Cohort

Cohort	Cohort	Daily Net kWh Savings from EE (Treatment Group)	Daily Net kWh Savings from EE (Control Group)	Uplift Percentage
1	2010	26.47	25.88	2.3%
2	2012-2013	6.86	6.75	1.7%
3	2014-2015	2.42	2.27	6.9%

3.2.7 Summer Demand Impacts

Nexant estimated MyHER demand savings using Duke Energy's system load profile data from 2014. This load profile data was provided to Nexant by Duke Energy's load forecasting team for residential customers in North Carolina. Nexant used the 2014 hourly demand estimate to identify the system peak demand hour of July 14, 2014, hour ending 17. Nexant applied the

proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 229.8 kWh; the result is an estimated MyHER residential peak demand savings of 0.05837 kW.

Table 3-15: MyHER Demand Impacts

Month	DEC Participant Count	Per Home kWh Savings	Aggregate MW
201507	1,057,508	0.05837	61,727

3.3 MyHER Interactive Portal

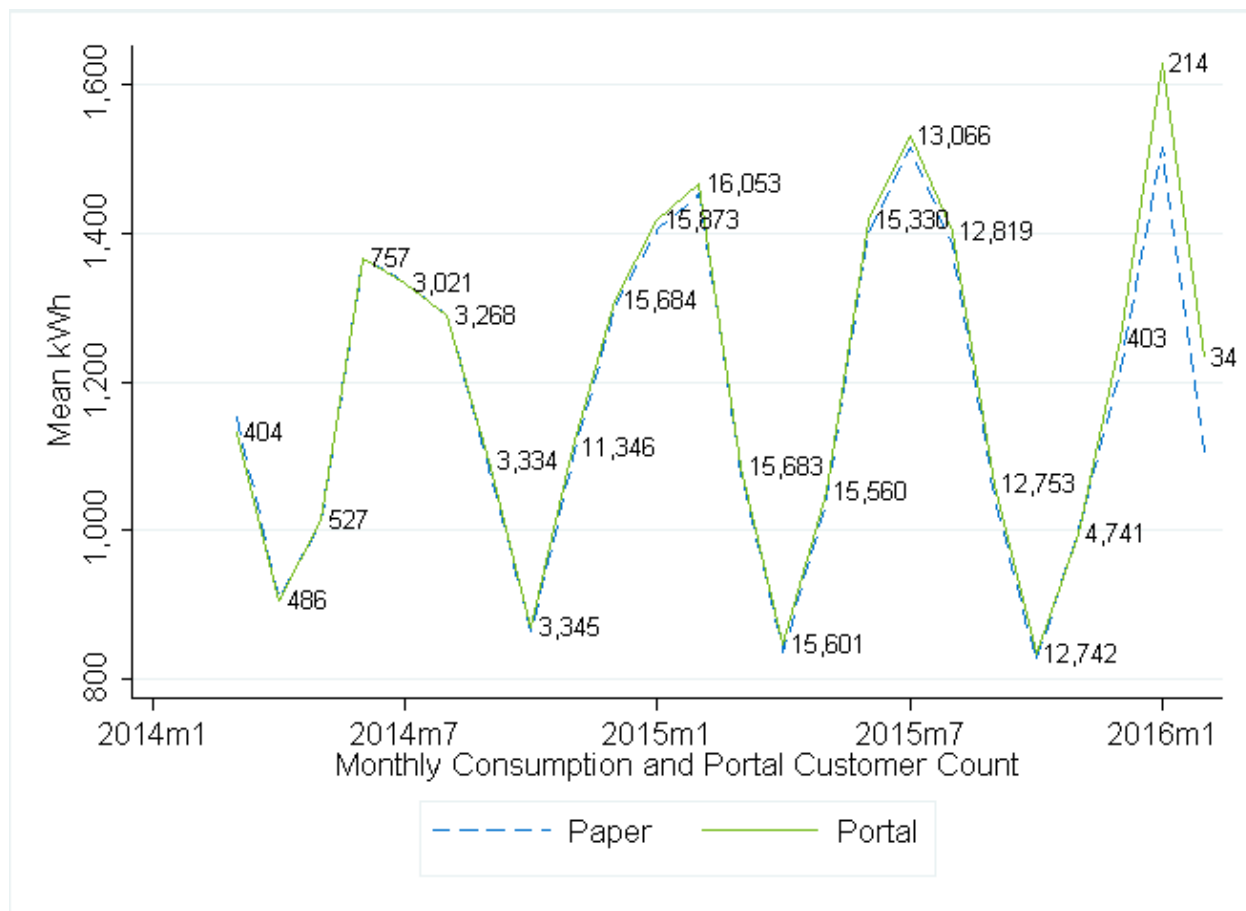
Nexant also evaluated the incremental energy savings generated by Duke Energy's new enhancement to the standard MyHER paper report. Duke Energy launched the MyHER Interactive Portal in March, 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer.

The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive also sends email challenges that seek to engage customer in active energy management, additional efficiency upgrades, and conservation behavior. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because the MyHER Interactive Portal was not deployed as a randomized, controlled trial (RCT).

3.3.1 Estimation Procedures for MyHER Interactive

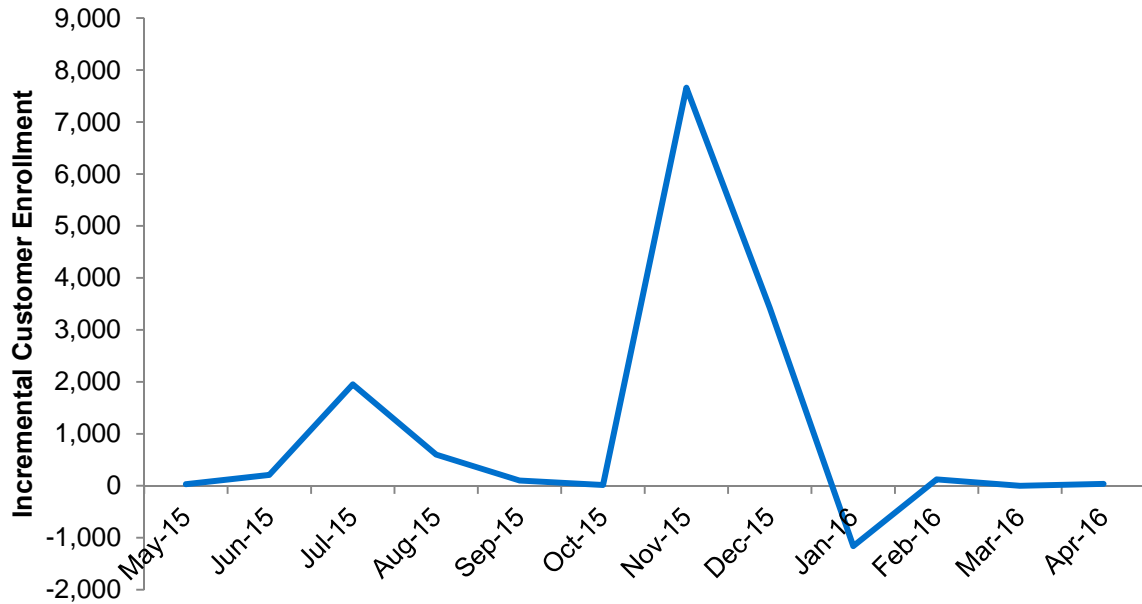
A matched comparison group is a standard approach for establishing a counterfactual baseline when there is no random assignment to treatment and control. The goal of matching estimators is to estimate impacts by matching treatment customers to similar customers that did not participate in the program. The key assumption to matched comparison approaches is that MyHER Interactive participants closely resemble non-participants, except for the fact that one of these two groups participated in the program while the other did not. When a strong comparison group is established, evaluators can reliably conclude that any differences observed after enrollment are due to program's stimulus. After replacing the control group with a matched comparison group, the same statistical modeling approach is used to estimate energy savings impacts. Figure 3-5 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER customers that receive only paper reports. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. Some minor differences remain among the limited numbers of customers that signed up towards the end of this current evaluation period; yet, the fixed effects model specification Nexant applies controls for pre-treatment differences, as discussed earlier in section 3.1.5.

Figure 3-5: MyHER Interactive Portal Customers and Matched Comparison Group



Customers signed up for the MyHER Interactive Portal on a monthly basis, beginning March 2015. Figure 3-5 presents average consumption for such customers in the year prior to enrolling in the MyHER Interactive Portal. The values labeled in Figure 3-5 indicate the number of MyHER Interactive Portal customers that were matched on the basis of pretreatment consumption in each month. The values grow and decline over time in a manner that reflects the signup pattern of MyHER Interactive Customers: the early months show some early adopters while the middle months indicate the pre-treatment period with the greatest share of MyHER participants. This trend is more clearly indicated below in Figure 3-6, which plots the number of customers signing up for MyHER Interactive in each month of the impact evaluation period.

Figure 3-6: Incremental MyHER Interactive Portal Enrollment



3.3.2 Results and Precision

Duke Energy participant counts indicate the total enrollment for the MyHER Interactive portal in April 2016 was 12,987 customers for the DEC territory. This figure represents approximately 1.2% of total MyHER participants. For this evaluation period, the MyHER Interactive Portal savings estimates are too uncertain to determine whether the portal generates incremental savings above and beyond the standard MyHER paper edition. Although impact estimates are very uncertain, it would also be premature to draw the conclusion that MyHER Interactive is not working, and statistical models of monthly impact reflect some directional consistency. Table 3-16 provides impact model results, along with the margin of error for estimated impacts.

Table 3-16: MyHER Interactive Model Results

Bill Month	Impact Estimate (kWh)	Margin of Error (kWh)
201505	7.3	57.1
201506	2.9	66.4
201507	-3.7	64.5
201508	-13.4	35.9
201509	-11	37.9
201510	-2.2	41.1
201511	-9.7	45.2
201512	-9.3	25.9
201601	-5.2	22.9
201602	-15.1	24.4
201603	-11.9	25.3
201604	-8.7	27.8
Annual Totals:	-80	146.6

Table 3-16 contains point estimates of monthly impacts for the MyHER Interactive component of the program. The point estimate for annual impacts indicates a savings of 80 kWh, but the margins of error around the estimates are larger than the point estimates themselves. Since the resulting error band for these impact estimates includes zero, Nexant cannot conclude that the MyHER Interactive Portal succeeded in generating additional savings during this evaluation period. Nexant also examined tracking data on MyHER Interactive sessions. Duke Energy provided Nexant with a record of approximately 37,837 separate MyHER Interactive sessions from May 2015 to April 2016. Despite the large number of customer login sessions, only 6,786 customers signed into the MyHER Interactive portal more than once, and only 3,428 signed in more than twice. Only 28 customers average longer than one minute per session.

3.4 Impact Conclusions and Recommendations

Nexant's impact evaluation shows that Duke Energy's MyHER program continues to trigger a reduction in electric consumption among homes exposed to the program messaging. MyHER is currently achieving 229.8 kWh annual savings within the time period evaluated. Although MyHER is achieving its primary target of delivering cost-effect savings to the company, and its secondary goal of promoting other DEC initiatives, Nexant provides the following conclusions and recommendations for consideration:

- ***The inconsistent assignment of homes to the MyHER treatment and control group over time has complicated the intended RCT experimental design.*** This issue complicates the impact analysis and increases uncertainty in the impact estimates for cohort 4. In the future, homes should always be assigned to the treatment group with a corresponding assignment of homes to the control group. Assignment of new accounts to the MyHER treatment and control group should be limited to once or twice per year.

- ***Continue to monitor engagement and evaluate the impacts of the Interactive Portal.*** However, for this evaluation period, the MyHER Interactive Portal savings estimates are too uncertain to determine whether the portal generates incremental savings above and beyond the standard MyHER paper edition. Although impact estimates are very uncertain, it would also be premature to draw the conclusion that MyHER Interactive is not working, and statistical models of monthly impact reflect some directional consistency.

4 Process Evaluation

This section presents the results of process evaluation activities including in-depth interviews with Duke Energy and implementation staff and a survey of control and treatment households.

4.1 Methods

Process evaluations support continuous program improvement by identifying opportunities to improve the effectiveness and efficiency of program operations and services. Process evaluations also identify successful program components that should be enhanced or replicated. Process evaluation activities for MyHER sought to document program operational processes and to understand the experience of those receiving MyHER mailings. The customer survey focused on investigating the recall and influence of MyHER messages among recipients, the extent to which MyHER affects customer engagement and satisfaction with Duke Energy, and subsequent actions taken by participants to reduce household energy consumption. A survey of control group households provided a point of comparison for estimating the effect of MyHER on behavior and attitudes of treatment households.

4.1.1 Data Collection and Sampling Plan

The process evaluation included two primary data collection activities: in-depth interviews with program management and implementation staff, and surveys with a sample of households selected to receive MyHER reports as well as a sample of control group households.

Nexant deployed the household surveys using a mixed-mode survey measurement protocol, outlined in Table 4-1. In this protocol customers were contacted by letter on Duke Energy stationery (to assure recipients of the validity of the survey) asking them to go online and complete the survey. The letter contained a two-dollar bill as a cost-effective measure to maximize the survey completion rates. The letter also included a personalized URL for the online survey that points the recipient to a unique location on the internet at which they were able to complete the survey. Customers for whom email addresses were available also received an email inviting them to take the survey online, which also included the same personalized URL that appeared in the letter leading to the survey website at the location where they could complete it. After three weeks, customers who did not respond to the web survey received another letter, this time containing a paper copy of the survey and a return postage-paid envelope asking them to complete the survey by mail. Survey recipients also had the option of calling Nexant at toll-free telephone number to complete the survey by telephone.

Table 4-1: Summary of Process Evaluation Activities

Population	Approach	Population	Sample		Confidence/Precision	
			Expected	Actual	Expected	Actual
Program management and implementation	In-depth interviews	~10	2-5	3	Not applicable	Not applicable
Treatment households	Mixed-mode; mail, web, and phone	~1,200,000	189	233	90/06	90/06
Control group households	Mixed-mode; mail, web, and phone	~120,000	189	213	90/06	90/06

4.1.1.1 Interviews

Nexant conducted interviews with key contacts at Duke Energy and at Tendril. The interviews built upon information obtained during 2015 evaluations of the Duke Energy Ohio and Duke Energy Indiana MyHER programs and allowed the evaluation team to understand any developments or enhancements in program delivery in 2016. A central objective of the interviews was to understand program operations and the main activities required to develop and mail the MyHER to DEC customers approximately eight times a year.

4.1.1.2 Household Surveys

Both treatment and control groups were surveyed. For the treatment households, the survey included questions about the experience of the reports themselves as well as questions to assess engagement and understanding of household energy use; awareness of Duke Energy efficiency program offers; and satisfaction with the services Duke Energy provides to help households manage their energy use. The control group survey excluded questions about the information and utility of the MyHER reports, but included identical questions on the other aspects to facilitate comparison with the treatment group.

Nexant analyzed the survey results to identify differences between treatment and control group households on the following:

- Reported levels of stated intention for future action;
- Levels of awareness of and interest in household energy use;
- The level of behavioral action or equipment-based upgrades;
- Satisfaction with Duke Energy service and efficiency options; and
- Inclination to seek information on managing household energy use from Duke Energy.

This survey approach is consistent with the RCT design basis of the program and supports both the impact and process evaluation activities by providing additional insight into potential program effects.

Survey Dispositions

We mailed 566 letters to randomly selected residential customers in both the treatment and control groups respectively. The survey was completed by 213 treatment households and 233 control households, representing a treatment group response rate of 38% and a control group response rate of 41%. The treatment group had a higher percentage of respondents completing the survey online, as compared to the control group: 58% of the treatment group surveys were completed online while 44% of the control group surveys were completed online. Table 4-2 outlines the treatment and control group survey dispositions.

Table 4-2: Survey Disposition

Mode	Treatment		Control	
	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	123	58%	103	44%
Mail/Paper Survey	75	35%	118	51%
Inbound Phone Survey	15	7%	12	5%
Total Completes	213	100%	233	100%

4.2 Findings

This section presents the findings from in-depth interviews with staff and implementation contractors and the results of the customer surveys.

4.2.1 Program Processes and Operations

Similar to other Duke Energy jurisdictions, MyHER for DEC is managed primarily through a core team of three Duke Energy staff members: a Behavioral Program Manager with oversight of both residential and nonresidential behavioral programs, a Program Manager in charge of the day-to-day operations of the MyHER program, and a Data Analyst responsible for the substantial data tracking and cleaning tasks that occur at Duke Energy to support the contracted implementation team.

At Tendril, Duke Energy's contracted program implementer, MyHER is supported by a team of people including an Operations Manager, a Home Energy Report Product Manager, and an Account Manager responsible for ensuring that the Duke Energy MyHER products meet expectations for quality, timing, and customer satisfaction. Tendril staff track the number of reports sent, the quality of the reports, the timing of reports, and indications of customer satisfaction.

As MyHER is Duke Energy's flagship behavioral energy efficiency program, its primary goals are to achieve energy savings, increase customer satisfaction, and cross-promote enrollment into Duke Energy energy efficiency and demand response programs. Staff at both organizations described continuous, close coordination to ensure that the data behind the MyHER graphs is

accurate, the tips provided to specific households are appropriate, and that MyHERs are delivered within the relatively short timeframe between bills. Program operations are conducted with a customer-focused orientation where the commitment to producing a high-quality product is a demanding process that must be executed consistently throughout the year.

4.2.1.1 MyHER Production

During the period of time under study by this evaluation, MyHERs were mailed out to DEC customers on paper through the U.S. Mail service about eight times a year, where the mailing gaps generally occurred in February, April, September, and November. During the eight treatment months, the reports are generated twice per week, a cadence that is designed to facilitate meeting a key performance indicator: that MyHERs arrive at the customers' homes near the mid-point of their billing cycle so as to make the information presentment as useful and timely as possible.

The production process for any given treatment month begins as soon as meter reads for the first billing cycle are processed by Duke Energy's meter data management system. After processing, billing data is uploaded nightly, five times a week, to Tendril. Once the data has been received, report production proceeds according to the following process: Tendril runs report production and conducts quality control checks. Then a flat file containing all the data from the reports is sent to Duke Energy for an independent quality control check. Upon approval, Tendril produces the PDFs of the reports and promotes them for another Duke Energy quality control check. Upon approval, Tendril then sends the PDFs to the print-house, and the print-house generates a final proof for Duke Energy approval. Finally, after the proof is approved, the print-house prints and mails all the reports, and commences the process of reporting the printing and mailing to Duke Energy.

This long production chain moves quickly: once Tendril generates a batch of reports, the time elapsed until transfer to the print-house is generally 2-3 business days when all processes are completed according to plan. If any quality control problems emerge, that elapsed time can double, which would likely result in the batch's cancellation and merge with the next batch. Considering that the print-house has one week to complete the mailing, and Standard Rate postage can take another week to deliver, making the mid-cycle in-home delivery goal takes dedicated effort to achieve.

This fast-moving process has seen improvements through the implementation of some changes: Firstly, by moving from a once-a-week mailings to twice-a-week. Additionally, Duke Energy has increased the speed with which the data transfer process to Tendril can be completed. These efforts have resulted in improvements in in-home date performance, and has enabled Tendril to realize service-level agreement (SLA) incentives for exceeding in-home delivery date goals.

Embedded in the early days of this production cycle is a quality control process that is undertaken to ensure that the reports contain accurate information and are of high quality production. Duke Energy analyzes a dataset containing all of the information presented in the

reports for each production cycle, and this data is checked for essentially anything that could be erroneous, ranging from verifying that all the customers receiving reports are eligible to receive them, that no control customers are getting reports, that the reported electricity usage is correct, that no customers who have opted-out are getting reports, and that no one has gotten more than one report a month. Duke Energy also checks for unexpected cluster assignment changes, presentment of messaging and tips and overall print quality.

These checks have proven to be crucial. In general, problems have not been found to occur every week but some have occurred each quarter, and are subsequently reviewed in Tendril's governance sessions. This visibility typically results in issue resolution on a going-forward basis, however, sometimes the same issues have been reported to pop back up a year or two later. It was recognized by both Duke Energy and Tendril staff that problems, when they occur, occur following changes to the report or cycle processes. The consensus was that when there are no changes implemented, the report generation cycle goes smoothly; all stakeholders agreed that managing changes to program operations is an important part of keeping deliveries running smoothly.

An important component of MyHER program change management and general operations is a shared document repository (Sharepoint) accessible to program staff across both Duke Energy and Tendril. The Sharepoint site contains areas for Duke Energy staff that present program dashboard information summarizing participation, reports of inbound customer calls, emails, and letters pertaining to MyHER. Information on the number of program opt-outs and reasons for opting out. The area shared with Tendril has documentation of approved program changes, contractual requirements, issue resolution logs and information on program processes, including messaging calendars for the free-form text section of the reports. Importantly, the Sharepoint site also documents the QC procedures undertaken internally prior to every report mailing. An original program operations playbook that was created at the inception of the MyHER program is still available and used as a reference document for program eligibility criteria and as a data dictionary.

Opportunities for improving the quality of MyHERs include successful resource planning and turnover management at Tendril, so that enough appropriate resources are consistently directed at the program. Turnover at Tendril was an issue raised in the MyHER evaluation at DEI, and it remained a theme for DEC as well: A key resource at Tendril that worked closely with Duke Energy with the report generation and QC processes left the company, and there was an outage of the appropriate level of support with respect to that resource's data-centric duties.

Other opportunities include continuing to maintain documentation in the MyHER Sharepoint files sharing repository that documents internal operations that are most critical to MyHER. Given that a relatively small team manages MyHER, this can help manage risk associated with the potential for turnover internal to Duke Energy. Also, the QC process would run more smoothly if Tendril could consistently deliver flat files on an agreed-upon schedule, or if delays to the schedule were less frequent. Also, stronger attention to upstream and downstream effects of

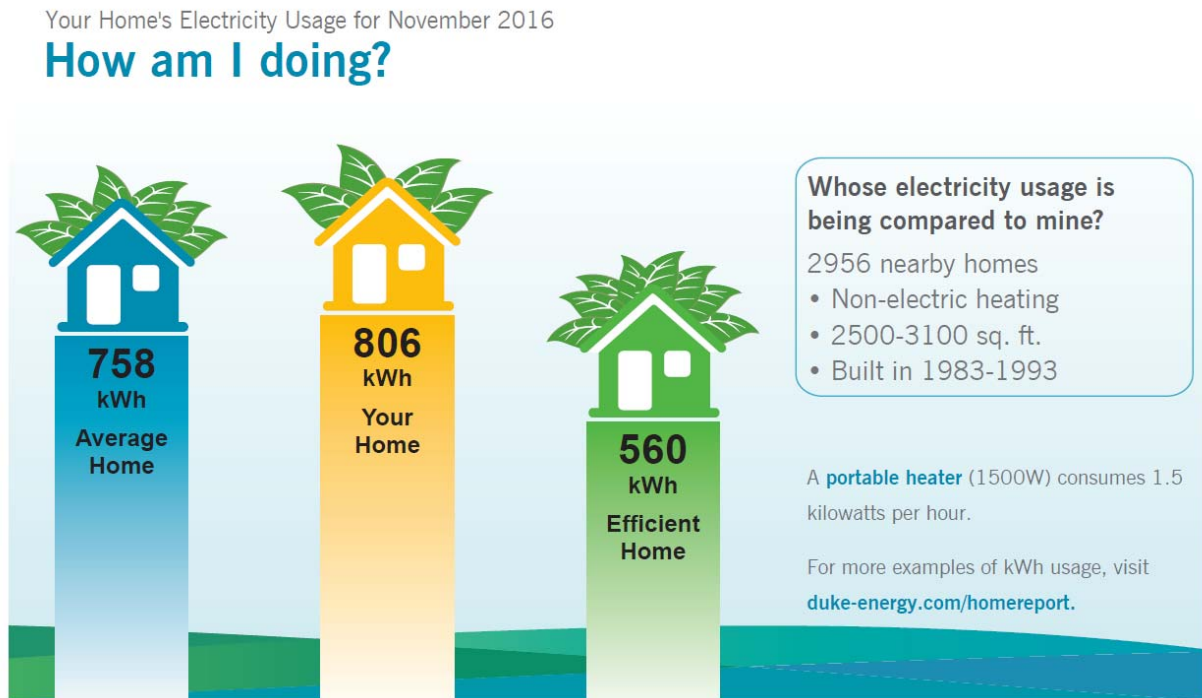
changes could reduce the likelihood of problems with report production, given that they generally occur on the heels of changes.

Duke Energy and Tendril staff all spoke highly of enjoying a relationship with strong and open lines of communications. The ability to prioritize product changes was recognized as an important enabler of successful change rollout.

4.2.1.2 MyHER Components

MyHER reports include several key elements that are customized each month: the bar chart, tips, trend chart, and messages. The front page includes a graph comparing the subject home to the average and most efficient homes for an assigned cluster or “neighborhood.” Previously, these graphs were labeled with dollars, but this occasionally caused confusion among recipients if the dollar amount didn’t exactly match their recall of a recent bill. In March 2013, Duke Energy shifted to using kWh as the unit of measurement for the bar charts; Duke Energy conducted customer focus groups in an effort to understand the level of confusion this shift might cause and found that customers reported not paying attention to unit of measurement: they were simply absorbing the shape and directionality of the bar charts (Figure 4-1).

Figure 4-1: MyHER Electricity Usage Comparison Bar Chart



This month, you spent **\$5 more** than the average home in your area. Ready to be better than average? Join the ranks of the efficient. We'd like to help by suggesting you try one of the tips below.

A small box next to the graph provides the size of the group of comparison homes, the assumed heating type, the approximate square footage, and the approximate age of similar homes.

According to MyHER staff, a common reason for customer phone calls about MyHER is simply correcting assumed information about a given home. For example, the MyHER could indicate that Duke Energy assumes a home has electric heat when it does not, or have a home in the wrong size category. Any corrections provided in this manner are considered highly reliable and are not changed based on subsequent uploads of third party data.

In addition to the comparison graph, each MyHER includes a set of customized tips under the heading “What can I do to save money and energy?” (Figure 4-2). These tips are designed to provide information relevant to homes with similar characteristics, as presented in the box accompanying the comparison graph.

Figure 4-2: MyHER Tips on Saving Money and Energy

Tips Based on Your Usage and Home Profile

What can I do to save money and energy?

A bright idea for outside!

Use efficient bulbs for your outdoor lighting

Save up to **\$15** per year.

Consider efficient compact fluorescent (CFL) bulbs for your outdoor lighting needs. CFL bulbs use 75% less energy, and they last 10 times longer than incandescent bulbs. Here's the bonus: CFL bulbs last so long, you won't have to get out your ladder as often to change them.

Reach for that crock pot all year!

Dust off that crock pot

Save up to **\$12** per year.

Cooking in a crock pot can be much more efficient and convenient than using your oven. A crock pot costs 10 cents to run for 8 hours while an oven costs 32 cents to run for just one hour. Dust off that crock pot and fill it with your favorite meal. You'll savor the flavor and enjoy the savings.

The left margin on the front page of each report contains elements consistent for all recipients: information about what the report does, why Duke Energy is sending them to customers, and email and telephone contact information. Customers occasionally contact Duke Energy with questions or concerns about MyHERs and, rarely, to opt-out. Duke Energy's efforts to maintain a high-quality MyHER customer experience is reflected by the high value that is placed on program participant satisfaction and as such, it is closely monitored. Only 1% of MyHER customers contact Duke Energy annually and less than 1% of MyHER treatment customers contact Duke Energy to opt-out. Prior studies have found a 70% top-three box² satisfaction

² Using an 11-point 0 to 10 scale to measure satisfaction levels.

score and the rigorous quality control efforts described earlier have kept most quality-related issues from ever reaching customers.

In addition, each MyHER includes a trend chart that displays how the recipient's home compares to the average and efficient home in energy usage over a year (Figure 4-3). This trend chart can help customers identify certain months where their usage increased relative to the efficient or average home—helping them focus on the equipment and activities most likely to affect their usage. For example, if a home tracks the average home until mid-winter and then spikes well above, that could indicate the heating equipment should be checked.

Figure 4-3: MyHER 12 Month Trend Chart

How am I doing over time?



Your usage for this month has **decreased** compared to a year ago. Your annual consumption is **\$534 more** than the most efficient homes in your area. Don't lose your momentum! Try these tips for additional ideas.

Finally, MyHERs include space on the back page for Duke Energy to include seasonal and programmatic (free-form) messaging that reflects Duke Energy-specific communication objectives. Ensuring that these messages are relevant and do not conflict with the actions or tips provided on the front page requires on-going coordination and monitoring. Occasionally the action text on the front page will be disabled to accommodate the free form text. These messages are developed annually in cooperation with Duke Energy's marketing and communications group. The schedule is maintained in a campaign calendar, which consists of primary and alternate messages for two content boxes. Duke Energy staff strive to develop messages that are clever, relevant, and upbeat—some recognize events on the calendar (such as Earth Day) while others provide specific program promotional information or promote general home upgrades (even for measures outside of current programs).

Program contacts confirmed that establishing the message calendar early in the program year and stabilizing the messages to avoid late changes continues to be challenging. The message calendar can be difficult to manage because of periodic changes to program promotions and incentive levels. A contact at Tendril confirmed this, noting that while they try to get this text solidified 30 days ahead of the mailing date in the calendar, last minute changes are not uncommon.

In addition to developing the messages included in each MyHER, the program team must also ensure that the messages conform to expectations established to protect the customer experience. Broad targeting efforts taking advantage of seasonal relevance, program eligibility, presence of end use such as pools, are used to cross-promote Duke Energy programs. Customer participation databases are cross checked each month to ensure that customers only receive information about programs they have not already participated in; if a customer is found to have participated in the program being promoted in a given month, that customer will receive an alternate, typically more generic message

Few issues were cited during staff interviews related to the production process specifically related to action tips and messaging. Messaging is part of the QC process and Duke Energy is working with Tendril to develop a tool for reviewing messaging proofs earlier in the production cycle.

Regarding tips, MyHER has a large library of actions tips, between 80 and 90. Half of them were initially developed internally at Duke Energy, and Tendril has continued to add to them. The large library has enabled the program to avoid any repeats to customers for the past three years. Tip freshness is also managed with display rules that ensure that a diversity of tip types (both in the value of the tip and the area of the household they apply to) is shown. There is an opportunity to comprehensively review the tip library to make sure they are still accurate and relevant. Here Duke Energy does check for quality as well: the monetary values estimated by Tendril for each tip action are validated for reasonableness.

4.2.1.3 MyHER Interactive

A MyHER web portal component, called MyHER Interactive, was introduced in March 2015. MyHER Interactive provides an opportunity for customers to log in, set and track goals, and access an “expert” for advice or questions on saving energy. Enrollment and login goals have not yet materialized at DEC as they had been hoped that they would: only 1.5% of Duke Energy’s customers have enrolled, and the initial goal was 5%.

To date, the most successful enrollment generators for MyHER Interactive have been prize sweepstakes and cross-promotion with the High Bill Alerts program. Envelope messaging has been introduced, and email campaigns have been found to be successful. The long-run viability of MyHER Interactive email campaign; however, it is hindered by the fact that Duke Energy has a limited number of emails. Staff interviews revealed that is Duke Energy initiative underway to increase the number of emails available for future email MyHER Interactive enrollment campaigns. The least successful promotion for MyHER Interactive has been promoting it inside the paper MyHERs.

While there is work to be done to enable Duke Energy to reach its MyHER Interactive enrollment goals, an encouraging finding is that there were no issues reported or described concerning Interactive’s production process or with respect to negative customer feedback.

4.2.1.4 MyHER Plans to Further Improve Program Operations

Looking forward, Duke Energy and Tendril have a number of plans underway that are anticipated to further improve program performance and the customer experience with the program:

- Reports will be introduced at the end of 2016 or early 2017 to customers in multi-family dwellings;
- A quality control process enhancement that will allow Duke Energy staff to access PDF proofs prior to promotion into downstream systems will be introduced that will make it easier correct problems if they are identified;
- An initiative will be underway to visually refresh the MyHER product to include more pictures and to update report colors;
- Work to increase enrollment in MyHER Interactive will continue to take place; and
- The viability of producing reports for dual-fuel customers will be studied and considered.

4.2.2 Customer Surveys

The customer surveys included a section of questions focused specifically on the experience of and satisfaction with the information provided in MyHERs—these questions were asked only of households in the treatment group. Both treatment and control households answered the remaining questions, which focused on assessing:

- Awareness of Duke Energy efficiency program offers;
- Satisfaction with the services Duke provides to help households manage their energy use;
- Levels of awareness of and interest in household energy use; motivations and perceived importance; and
- Reported behavioral or equipment-based upgrades.

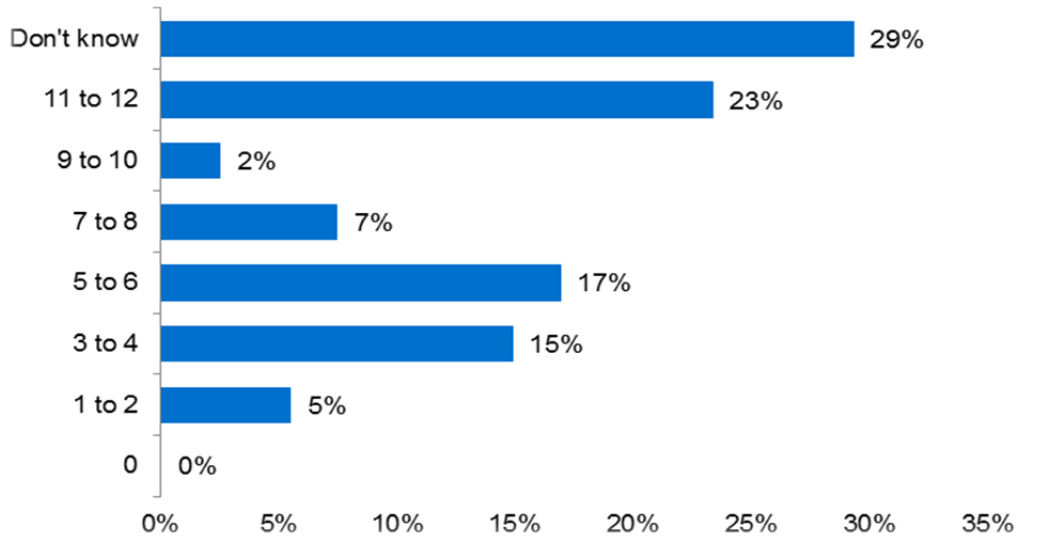
4.2.2.1 Treatment Households: Experience and Satisfaction with MyHER

Nearly all of the treatment household respondents (94%, or 201 of 213) recalled receiving at least one of the MyHER reports.

The survey asked those that could recall receiving at least one MyHER if they could recall how many individual reports they had received “in the past 12 months” (Figure 4-4). The survey launched in August 2016, which means that most recipients would have received 5-6 MyHERs. Twenty-nine percent (59 of 201) responded that they could not identify the number of home energy reports were received “in the past 12 months.” The distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the

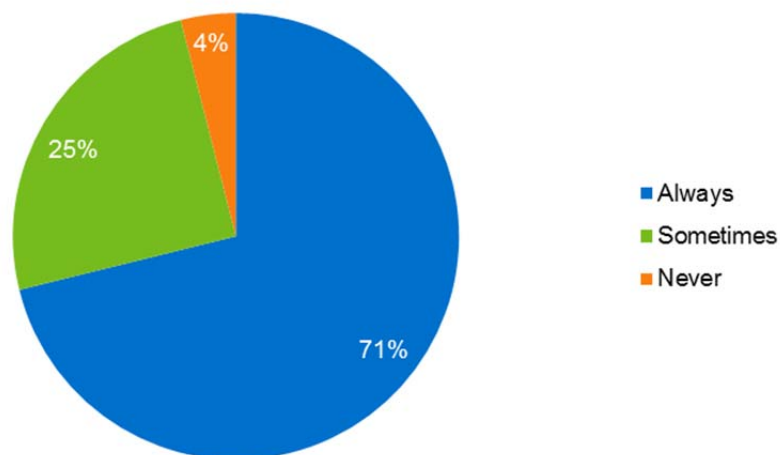
question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document.

Figure 4-4: Reported Number of MyHERs Received “In the past 12 months” (n=201)



Survey respondents indicated high interest in the MyHER reports. As shown in Figure 4-5, when asked how often they read the reports, 96% of respondents indicated they “always” or “sometimes” read the reports. Eight respondents (4%) indicated they do not read the reports.

Figure 4-5: How Often Customers Report Reading the MyHER (n=201)



Despite a high “open rate” for MyHER reports, only 39% (76 of 193) of survey respondents recalled specific tips from their reports (Table 4-3). The survey asked these 76 respondents to

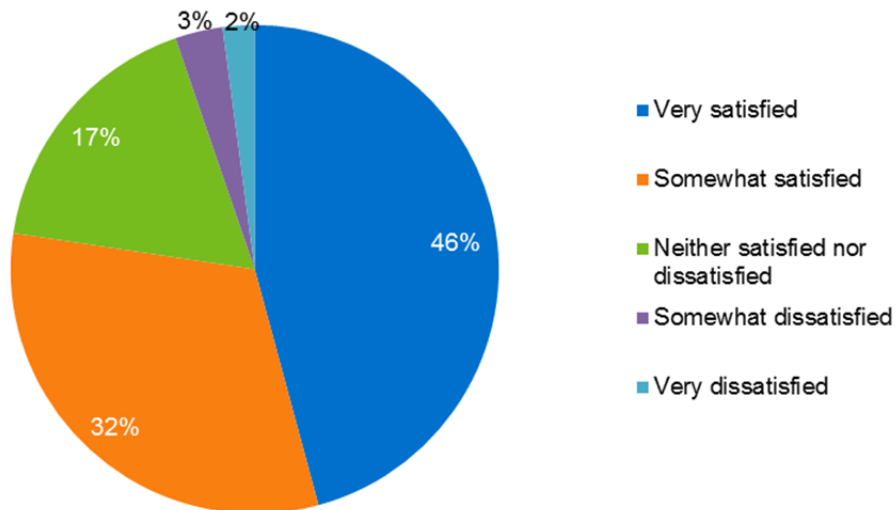
then provide an open-ended description of the specific tips they could recall. Sixty-eight respondents were able to recall 112 separate MyHER tips. The most commonly reported tips included thermostat setting, switching to energy efficient lighting, and insulation/weatherization recommendations.

Table 4-3: Distribution of Recalled Tips/Information (Multiple Responses Allowed)

Tip or Information	Count	Percent of Respondents Mentioning (n=68)	Percent of Total Mentions (n=112)
Thermostat settings	16	24%	14%
Efficient lighting	30	44%	27%
Weatherization	17	25%	15%
Cold water	5	7%	4%
Upgrade TV/appliance	8	13%	8%
Turn things off/unplug	9	13%	8%
Comparison	6	9%	6%
Hot water	5	7%	4%
Other	11	19%	12%

Seventy-seven percent (147 of the 190 respondents that provided a rating) reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-6).

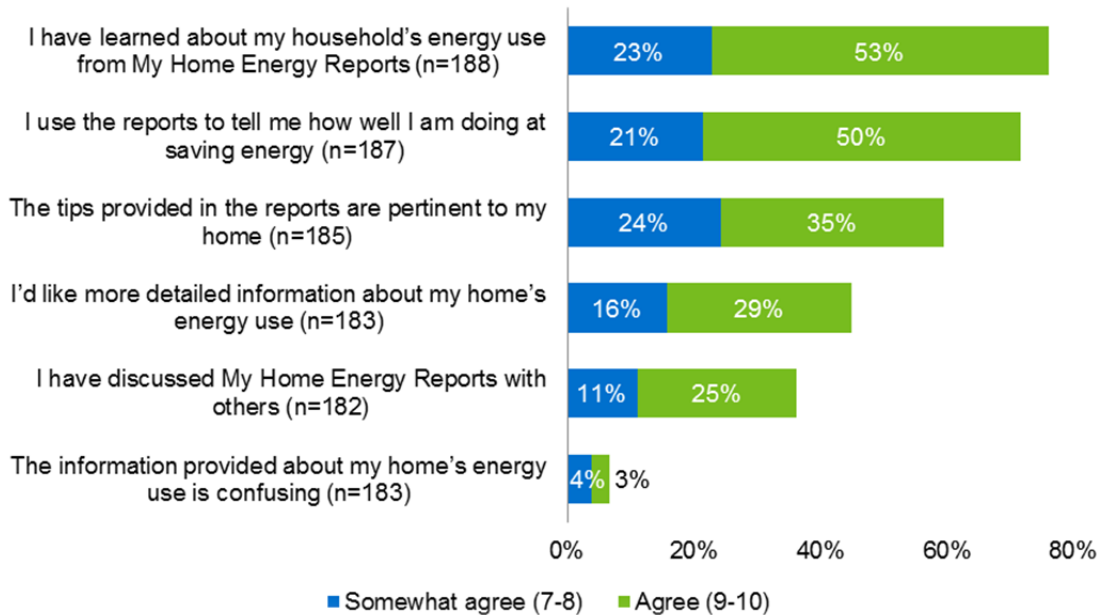
Figure 4-6: Satisfaction with the Information in MyHER Reports (n=190)



When asked to rate their agreement with a series of statements about MyHERs on a scale of 0 to 10, recipients largely agreed that the reports helped them understand their home’s energy use, with 76% of respondents rating their agreement a seven or higher on a 0-10 point scale, and that they use the report to gauge how successful they are at saving energy (72% rating a

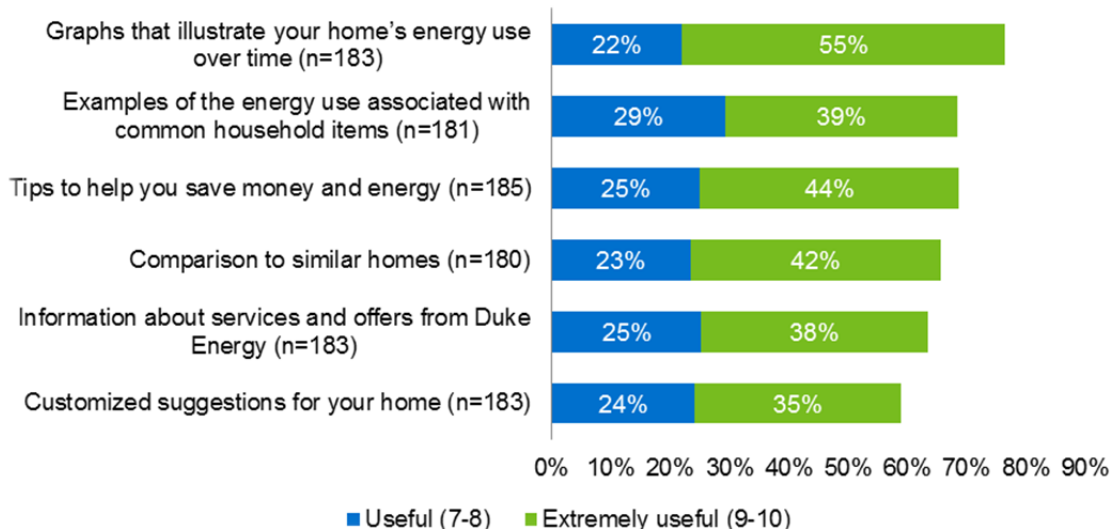
seven or higher). Respondents provided weaker agreement to statements about the applicability of the tips provided and desire for more detailed information. Encouragingly, a very small percentage (7%) agreed that the information provided is confusing (Figure 4-7).

Figure 4-7: Level of Agreement with Statements about MyHER (0-10 Scale)



The results shown in Figure 4-8 illustrate that 77% of respondents in treatment group rated the time series graphs of home energy consumption a seven or higher on a 0-10 point scale of usefulness, indicating that treatment households found this feature very useful, followed by a 69% useful rating for both examples of the energy use associated with common household items and tips to help save money and energy. Treatment households rated the time-series graphs more useful than the other MyHER features, as indicated in Figure 4-8. The usefulness of customized suggestions for home was rated the lowest, receiving a seven or higher score of 59%.

Figure 4-8: Rating Usefulness of Key HER Features (0-10 Scale)



The survey provided an open-ended question to elicit suggestions about potential improvements to MyHER among those that had reported reading at least one report. Only 28% (56 of 201) offered suggestions, including sixteen who offered only appreciative comments. Among those offering suggestions for improvement, the most common request, mentioned by 17 of the 56 with suggestions, reflected a desire for more specific information or details about their home and specific actions they should take. Some of these requests reflected interest in understanding at a more granular level how their home uses energy and energy consumption information related to appliances:

- *"I would like to see the actual kWh used under each column (Month/Year). Also, I would like to see 14 months in graph of usage by month."*
- *"Include which days during month are highest in energy consumption and efficiency."*
- *"Indicate in what area energy could be saved."*
- *"When the technology becomes available, more information about what appliances specifically is using the most energy and where improvements can be made."*
- *"A report that specifically tells about how much energy is used for each appliance."*

Other comments centered on unique features or occupancy patterns at respondent homes, disbelief in the relevance of comparison homes, and a few respondents that simply did not see value in the reports. Responses coded as recommending production changes included a variety of different, even conflicting, suggestions, including:

- *"Keep sending the reports and you can send them to an email address to save paper and cost of mailing?"*

- “More often.”
- “Send with bill, not separate.”
- “I think the reports are a waste of money for Duke Energy. I think you could save printing cost, stamp and labor and put toward your grants, or lower customer bills.”

Nexant categorized these suggestions on the basis of their content; the results are presented in Table 4-4. Suggestions categorized as “other” include requests for list of companies in the area that provide energy saving procedures, and reminders to clean or change filters, etc.

Table 4-4: Distribution Suggestions for Improvement (Multiple Responses Allowed)

Suggestion	Count	Percent of Respondents Mentioning (n=56)	Percent of Total Mentions (n=60)
Provide more specific information or details	17	30%	28%
Don't believe comparison/accuracy	9	16%	15%
Appreciate the HER	17	30%	28%
Expressed frustration	2	4%	3%
Other suggestions	5	9%	8%
Don't see value/dislike	6	11%	10%
Address unique home/circumstances	2	4%	3%
Change production (mail, paper, format)	2	4%	3%

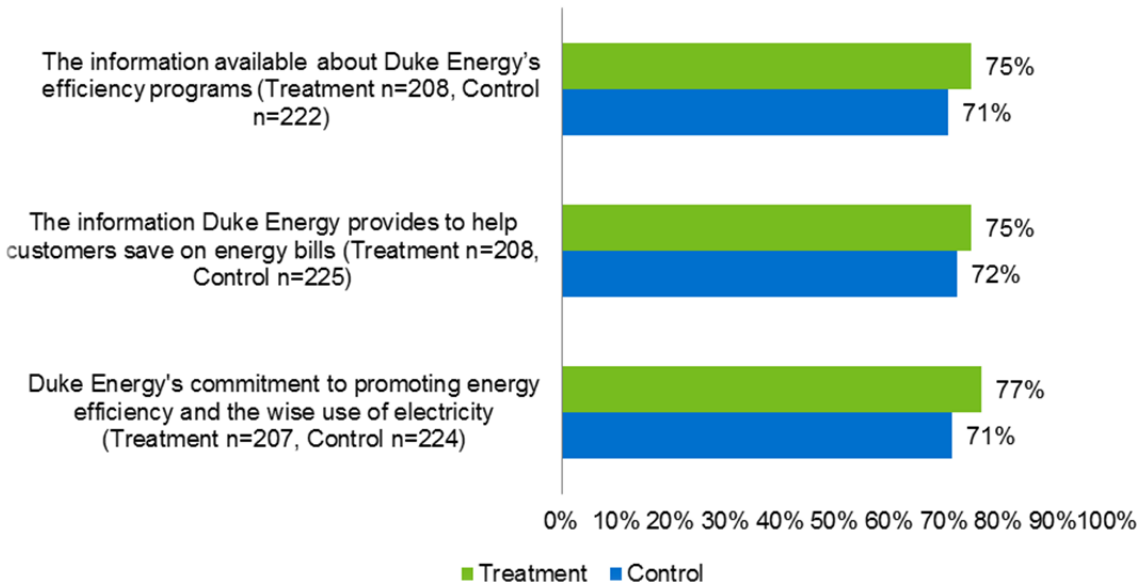
4.3 Comparing Treatment and Control Responses

This section presents the results of survey questions asked of both treatment and control households and compares the response patterns provided. Statistically significant differences between treatment and control households are noted.

4.3.1 Perception of Duke Energy

Both treatment and control groups' overall satisfaction of Duke Energy are high. Seventy-five percent of treatment customers and 67% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated eight or higher on a 0-10 point scale), a statistically significant difference with a 90% level of confidence. Treatment group responses indicate somewhat higher levels of satisfaction with certain aspects of DEC energy efficiency efforts than the control group (Figure 4-9). However, the difference between treatment and control customers with respect to the portion of customers who report being satisfied with these areas of DEC energy efficiency efforts is not statistically significant.

Figure 4-9: Portion Satisfied with Each Communication Element



4.3.2 Engagement with Duke Energy Website

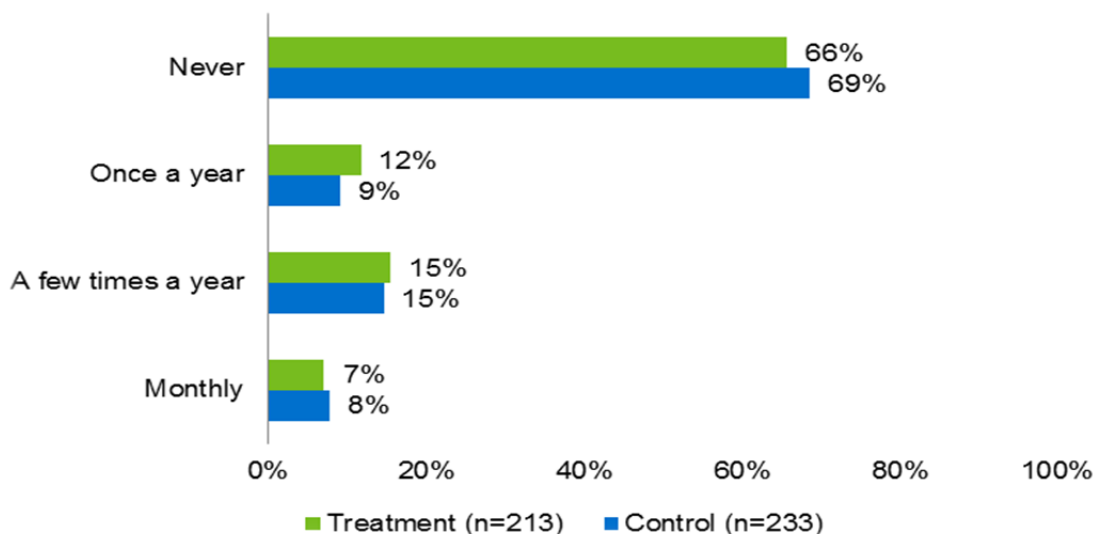
Both groups answered several questions about their use of the Duke Energy website, a proxy for overall engagement with information provided by the utility on energy efficiency and household energy use. Over half of both groups reported they had never logged in to their Duke Energy account. Among those that had logged in, the most commonly reported purpose was to pay their bill. None of the differences in online account usage between treatment and control respondents were statistically significant.

Table 4-5: Use of Duke Energy Online Account

On-line Account Activity	Treatment Group (n=213)	Control Group (n=233)
Never logged in	51%	52%
Pay my bill	31%	33%
Review energy consumption graphs	17%	17%
Look for energy efficiency opportunities or ideas	13%	11%

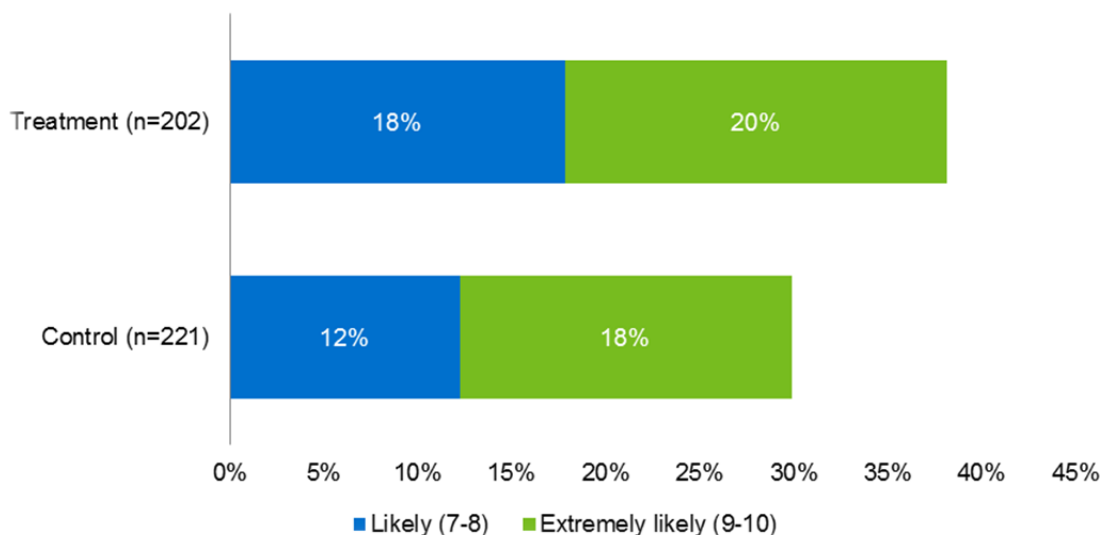
Treatment group households were more likely to report they accessed the Duke Energy website to search for *other* information (for example, information about rebate programs, or how to make their home more energy efficient), but the difference is not statistically significant. Relatively small percentages of both groups report regular usage of the website for purposes other than bill payment.

Figure 4-10: Frequency Accessing the Duke Energy Website to Search for Other Information



About one-third of both groups reported they would be likely to check the DEC website for information before purchasing major household equipment. The portion rating their likelihood a “7” or higher on a 11-point scale is plotted in Figure 4-11.

Figure 4-11: Portion Likely to Check DEC Website prior to Purchasing Major Home Equipment*

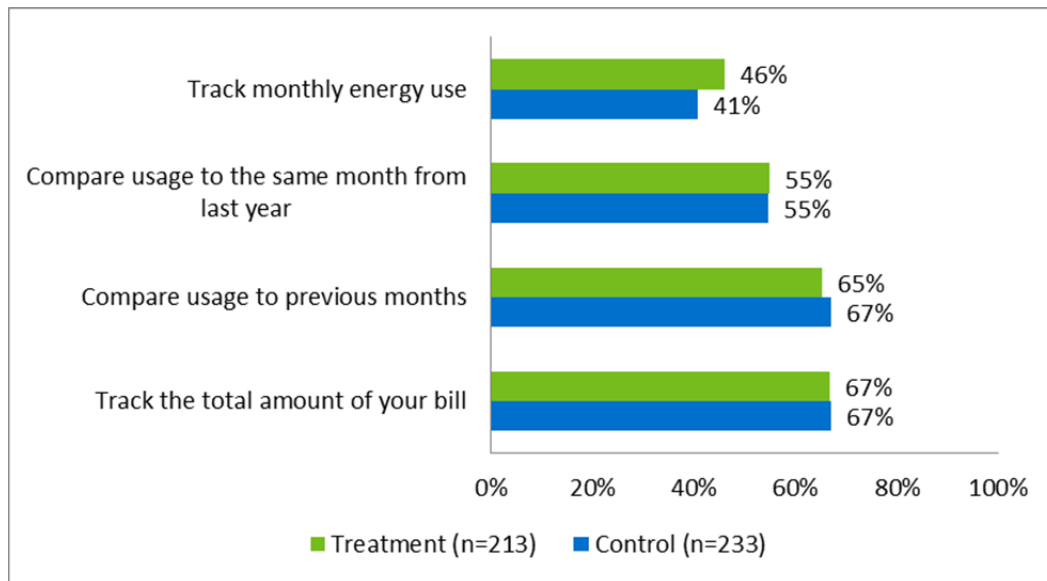


* Statistically significant, p=0.073

4.3.3 Reported Energy Saving Behaviors

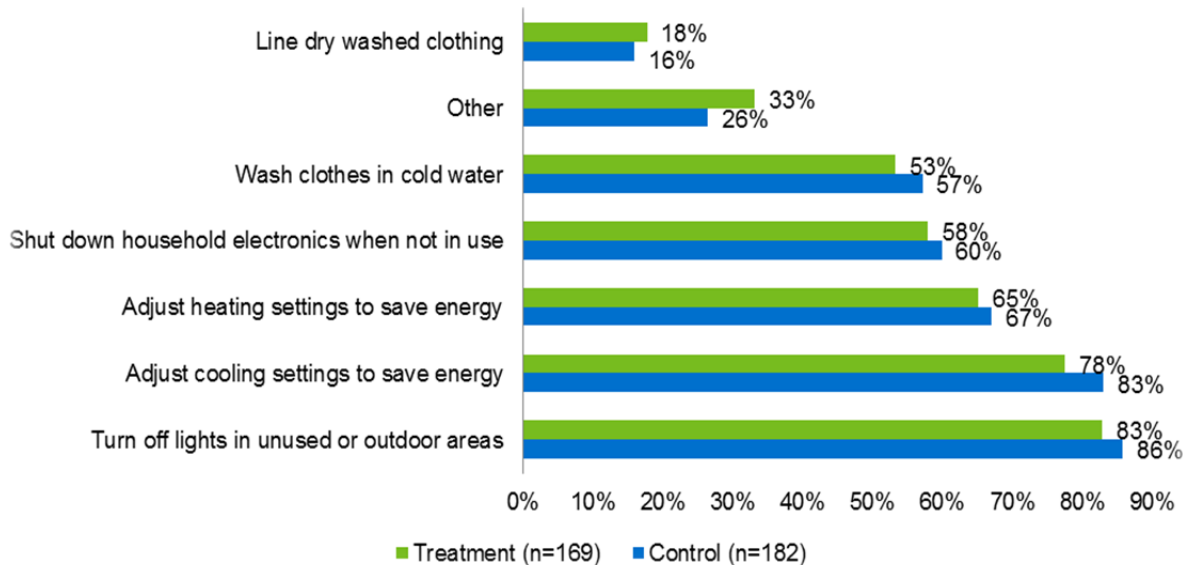
Both groups of respondents report similar strategies for tracking the total amount of the bill and comparing usage to the same month from last year. The treatment group was more likely to track monthly energy use, but the control group was more likely to compare usage to previous months. Figure 4-12 depicts these results.

Figure 4-12: “Which of the Following Do You Do with Regard to Your Household’s Energy Use?”



Both groups also reported similar levels of energy saving behaviors, as shown in Figure 4-13. The treatment group was slightly more likely to line dry washed clothing. Control customers were slightly more likely to wash clothes in cold water, adjust heating/cooling settings, turn off lights in unused or outdoor areas and shut down household electronics when not in use. None of these differences in reported energy savings behaviors are statistically significant.

Figure 4-13: Reported Energy Saving Behaviors



4.3.4 Equipment Purchases: Past and Future Intention

Respondents were provided with a list of potential energy efficiency improvements to their home that customers only rarely implement and asked if they had already done or intended to do each one. Similar portions of each group reported having already completed each upgrade (Table 4-6)..

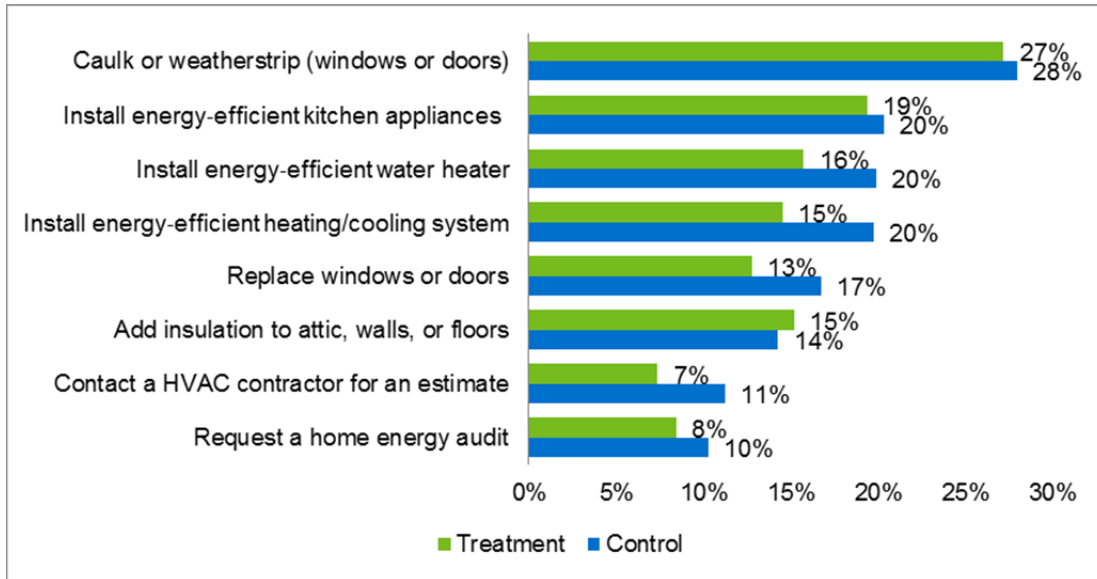
Table 4-6: Portion Indicating they had “Already Done” Each Upgrade

Upgrade	Control n=233	Treatment n=213
Install energy efficient kitchen appliances	27%	28%
Install energy-efficient heating/cooling system	30%	26%
Install an energy efficient water heater	26%	28%
Replace windows or doors	21%	22%
Caulk or weatherstrip (windows or doors)	24%	23%
Add insulation to attic, walls, or floors	21%	23%
Contact a HVAC contractor for an estimate	6%	9%
Request a home energy audit	4%	6%

Treatment and control group responses were mixed when participants were asked to rate the likelihood of completing the same list of potential energy upgrades in the next 12 months. Perhaps unsurprisingly, the most commonly reported likely upgrade for both groups is the one homeowners can complete without help from a professional; caulking windows and doors. In fact, the tips offered emphasize the “do-it-yourself” aspect of caulking and sealing. The control group reported higher likelihood of contacting an HVAC contractor for an estimate, requesting a

home energy audit, installing energy efficient kitchen appliances, replacing windows or doors, installing energy-efficient heating/cooling system, and installing energy-efficient water heater. The treatment group was more likely to report planning to add insulation to attic, walls or floors. The portion of each group reporting a “7” or higher on a scale of 0 to 10 is presented in Figure 4-14. None of the differences between treatment and control groups are statistically significant.

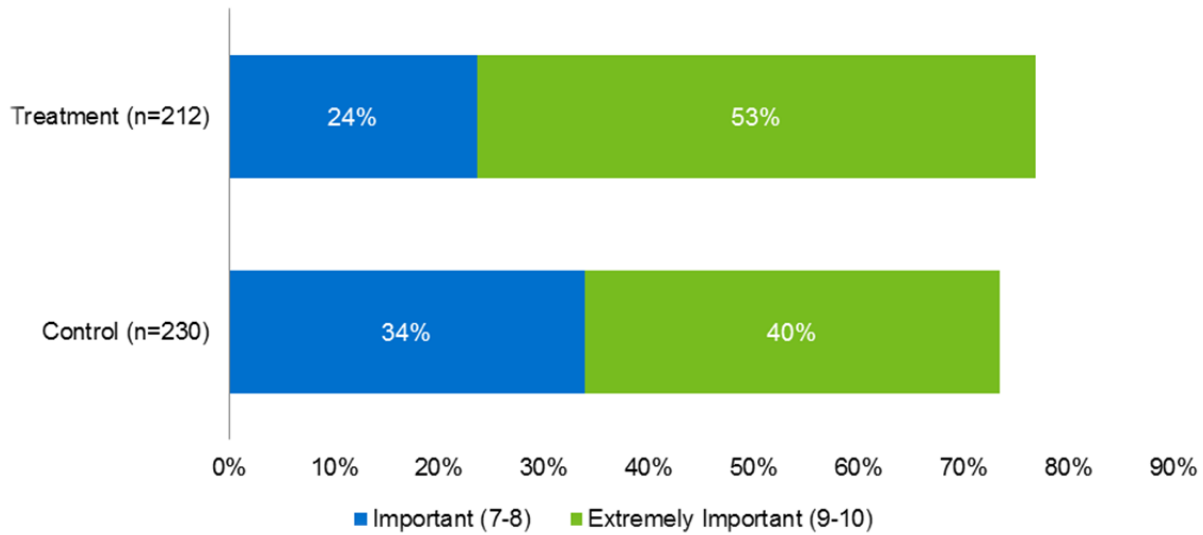
Figure 4-14: Likelihood of Completing Upgrades in the Next 12 Months



4.3.5 Customer Motivation and Awareness

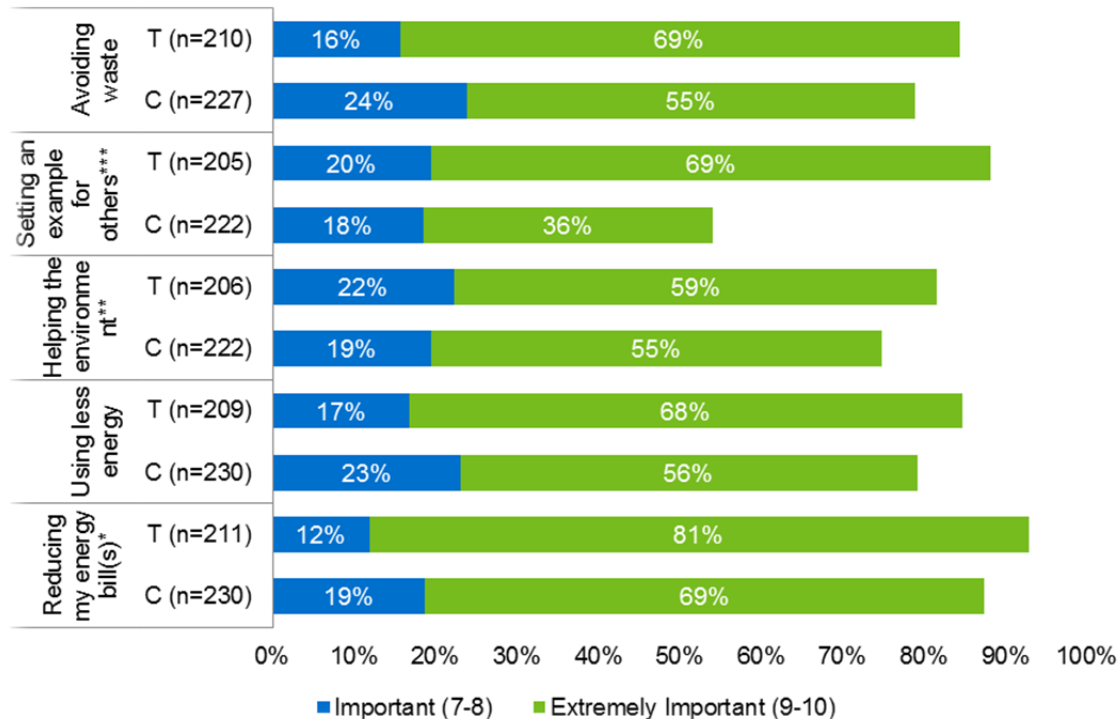
The treatment group is slightly more motivated than the control group to save energy. Seventy-seven percent of treatment customers indicated that knowing they are using energy wisely is important or very important, compared to 74% of control customers. This difference is not statistically significant (Figure 4-15).

Figure 4-15: “How Important Is It for You to Know if Your Household is Using Energy Wisely?”



Customers were asked to rate, on a scale of 0 to 10, the importance of various reasons they might try to reduce their home’s energy use. The strongest motivation for both groups is saving money on their energy bills, where 81% of treatment respondents reported that saving money on their energy bills was “very important” compared to 69% of control respondents, a statistically significant difference at the 90% level of confidence. Another significant difference was that 69% of treatment respondents indicated that “setting an example for others” was very important to them, while only 36% of control customers said as much; this difference is also statistically significant at the 95% level of confidence. “Helping the environment” was another statement that was more important to treatment customers than control customers; 59% of treatment customers felt that was very important to them compared to 55% of control customers, a statistically significant difference at the 90% level of confidence. Figure 4-16 contains the frequency of responses to this question, shown as a percentage for both the treatment and control group.

Figure 4-16: “Please Indicate How Important Each Statement Is to You”



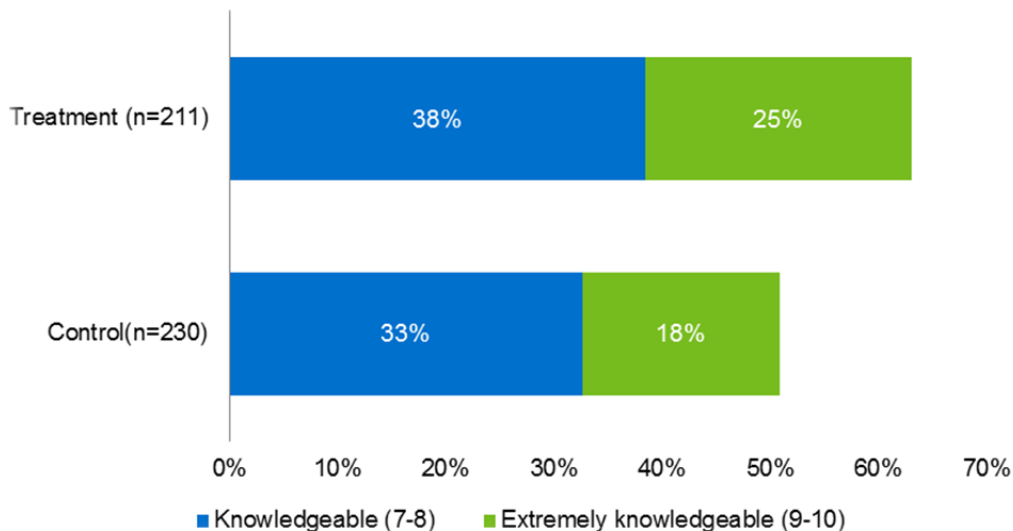
* Statistically significant, p=0.054

** Statistically significant, p=0.091

*** Statistically significant, p=0.039

As indicated by Figure 4-17, the treatment group was also more likely to rate themselves as knowledgeable about saving energy in the home. Within the group of treatment customers, 63% rate themselves above a seven on a 0-10 point scale. Only 51% of control group customers rated themselves this way. The difference is statistically significant at the 90% level of confidence.

Figure 4-17: “How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?”*



* Statistically significant, p=0.010

In Section 4.3.1 we presented the portion of treatment households that found each HER feature useful. A similar question was asked of control group respondents, somewhat rephrased to ask them how useful they might expect each feature to be. Table 4-7 presents the portion rating each item a “7” or higher on a 11-point scale. The treatment group rated the usefulness of the time series graph, examples of the energy use associated with common household items and comparisons to similar homes significantly higher than the control group.

Table 4-7: Usefulness, or Hypothetical Usefulness of HER Features, Treatment, and Control

HER Feature	Control Group	Treatment Group
Graphs that illustrate homes energy use over time*	60% (n=217)	77% (n=183)
Tips to help save money and energy	66% (n=224)	69% (n=185)
Examples of the energy use associated with common household items	62% (n=220)	69% (n=181)
Information about services and offers from Duke Energy	58% (n=219)	63% (n=183)
Comparisons to similar homes**	48% (n=219)	66% (n=180)
Customized suggestions for your home	53% (n=216)	59% (n=183)

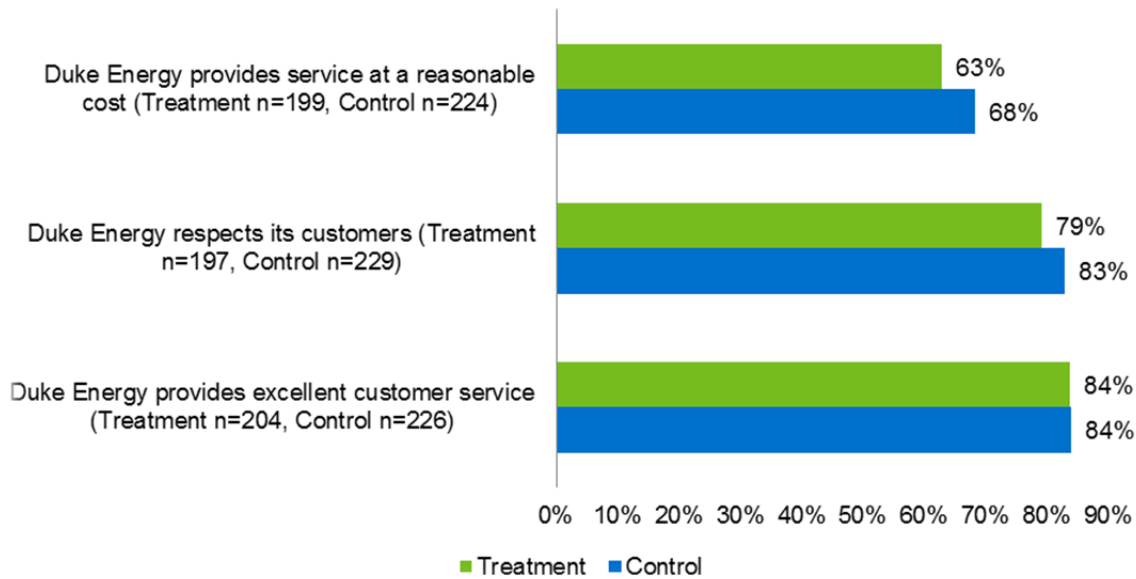
* Statistically significant, p=0.0004

** Statistically significant, p=0.001

4.3.6 Satisfaction with Duke Energy

Control households rated DEC higher on providing service at a reasonable cost and respect, and treatment and control group customers rated DEC the same on customer service (Figure 4-18), with 84% of respondents from both groups strongly agreeing with the statement that “Duke Energy provides excellent customer service”.

Figure 4-18: Evidence of Overall Satisfaction with Duke Energy



4.3.7 Evidence of MyHER Effects

As noted above, while formal statistical testing found some differences among treatment and control group households for individual questions, the Nexant team sought to understand if the overall pattern of survey responses differed among treatment and control households. To do this we categorized each survey question by topic area and then counted any survey item in which the treatment households provided a more positive response than the control households.

Nexant’s approach consists of the following logical elements:

- Assume the number of positive responses between treatment and control customers will be equal if MyHER lacks influence
- Count the total number of topics and questions asked of both groups
- Note any item for which the treatment group outperformed the control group
- Calculate the probability that the difference in response patterns is due to chance, rather than an underlying difference in populations.

Because this analysis compares the response patterns between the treatment and control groups, if the MyHER program did not influence customers, one would expect the treatment group to “score higher” on roughly half of the questions. In other words, if the MyHER is not

influencing treatment group customers, then there is a 50/50 chance that they will “outperform” the control group as many times as not. For a more detailed description of the index framework, see Appendix F.

The pattern of responses displayed in Table 4-8 indicates that the DEC MyHER program did not broadly affect the treatment group’s perception of Duke Energy, the group’s engagement with the website, or actions for low-cost energy-saving or past and future equipment purchases. However, treatment customers specifically showed favorable comparisons to the control group in the areas of perception of Duke Energy’s energy efficiency offerings and position and in motivation, engagement, and awareness of energy efficiency. The number of questions in these categories are too small to subject to a formal statistical test, but the results are indicative of more success in these areas relative to others. In fact, the area of customer motivation, engagement and awareness of energy efficiency is arguably a *raison d’etre* of behavioral programs such as MyHER; the increased engagement in this area among treatment customers should be viewed as a success in MyHER’s core mission.

Table 4-8: Survey Response Pattern Index

Question Category	Count of Questions where T>C	Number of Questions in Topic Area	Portion of Questions where T>C
Duke Energy’s Public Stance on Energy Efficiency	3	3	100%
Customer Engagement with Duke Energy Website	3	6	50%
Customers’ Reported Energy-saving Behaviors	2	7	29%
Customers’ Past & Future Equipment Purchases	7	16	44%
Customer Motivation, Engagement & Awareness of Energy Efficiency	8	11	73%
Customer Satisfaction with Duke Energy	1	4	25%
Total	24	47	51%

4.3.8 Respondent Demographics

Nearly all respondents—94% of treatment-group customers and 91% of control-group customers—own their residence. More than half of households surveyed have two or fewer residents, but about 18% of treatment households and 22% control households have four or more residents. There are no apparent, systematic differences in the age of homes assigned to the treatment and control groups (Figure 4-19).

Figure 4-19: “In What Year Was Your Home Built?”

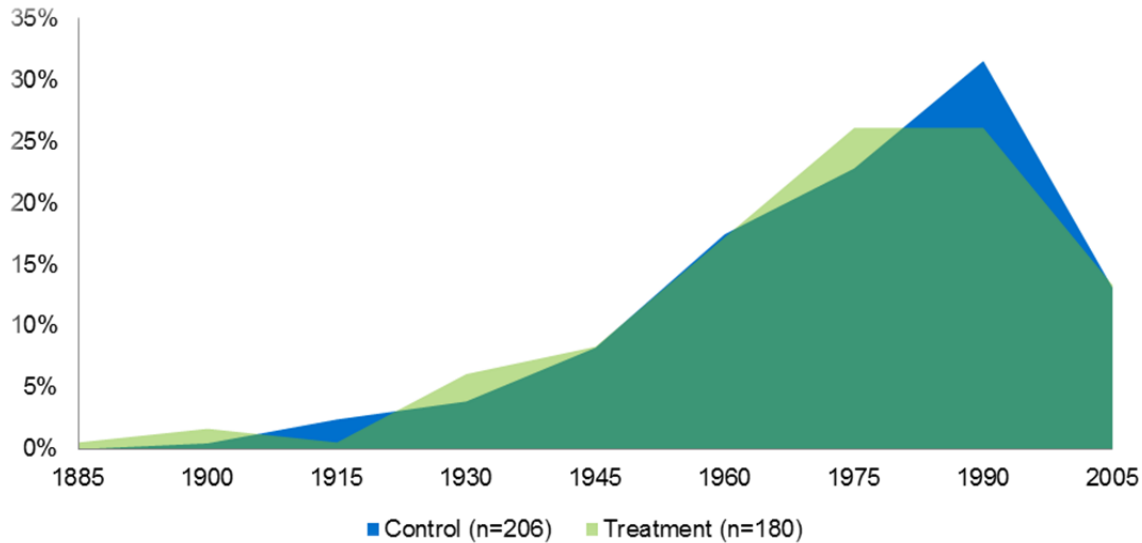
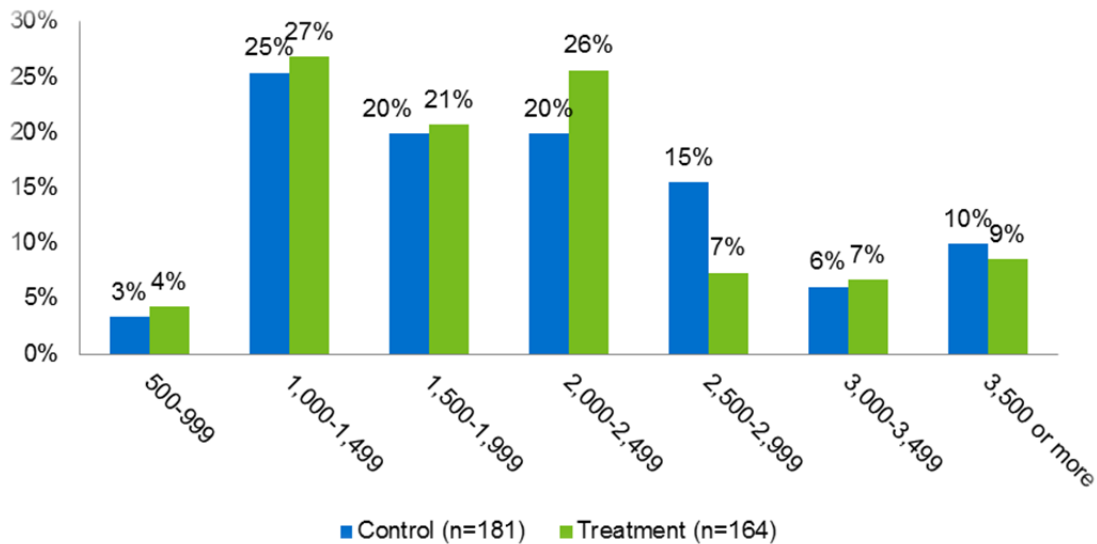


Figure 4-20 shows distribution of home square footage is similar between control and treatment households. The average square footage above ground is 2,260 for control households and 2,110 for treatment households.

Figure 4-20: How many square feet is above-ground living space?



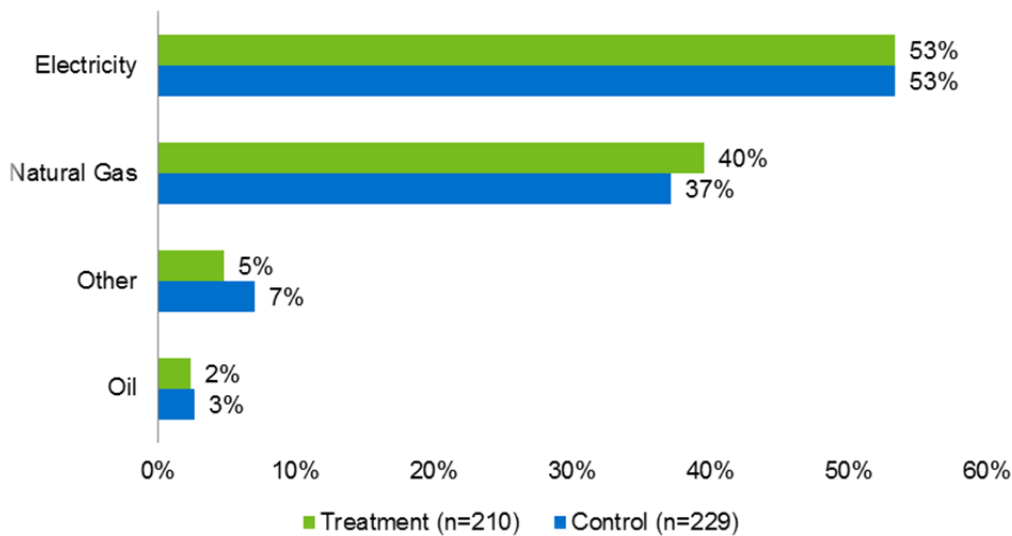
Respondent samples are relatively close to those reported by the U.S. Census for the Carolinas. The lowest age category (25-34) is often underrepresented when sampling based on residence in single family homes, given that many members of that population are in apartments, dormitories, or living with other family members. This common underrepresentation was true in this survey study, as well. The average age of control and treatment group respondents was 58 and 60 respectively (see Table 4-10).

Table 4-9: Respondent Age Relative to Carolinas Census

Age	Treatment Group (n=189)	Control Group (n=210)	Carolinas Census
25-34	3%	8%	13%
35-44	13%	14%	13%
45-54	18%	18%	14%
55-59	17%	12%	7%
60 and over	49%	48%	20%

Figure 4-24 shows the primary heating fuel type used in control and treatment customers' households. The majority of treatment (53%) and control (53%) customers use electricity in their households for heating. Forty percent of treatment customers and 37% of control customers use natural gas for heating. Forty percent of treatment customers and 37% of control customers use natural gas for heating.

Figure 4-24 Primary Heating Fuel in Households



4.4 Summary of Process Evaluation Findings

The DEC MyHER program has benefited from a number of process and product management improvements that have enabled meeting and sometimes exceeding in-home date goals. These goals are designed to ensure that reports arrive as close to the mid-point of the customer's billing cycle as possible, maximizing the timeliness and utility of the information presented. These improvements include speeding up the data transfer speed between Duke Energy and Tendril, increasing the frequency of report mailings from once per week to twice per week, and prioritizing major program changes and rollouts. One example of change prioritization was the decision to implement the program roll-out to customers in multi-family dwellings in series, rather than in parallel, with the introduction of Tendril's new clustering algorithm. Both Duke

Energy and Tendril staff noted the importance of careful change management as an enabler of maintaining a production process that consistently meets quality control standards.

The DEC MyHER program is delivered to more than one million residential customers in the Carolinas and is managed with high attention to quality and customer service. Both Duke Energy and Tendril staff described a rigorous quality control process that has been very successful in preventing lapses in report quality from reaching the customers. Areas for improvement to the program generally circle around opportunities to better support this process and manage risks to it. Appropriate staffing at Tendril to support the technical and data-centered ongoing quality control processes for report mailings is critical to success in this area. Additionally, increased adherence or better development of a data delivery schedule on Tendril's part to initiate the quality control process will improve Duke Energy's ability to conduct their checks in a timely and complete manner. The increased pace of report mailings represents a long chain of quality control tasks for Duke Energy; responsibility for completing these tasks rests with a relatively small staff; Duke Energy should contemplate and manage risks to MyHER program operations presented by turnover or outages in availability of their staff, planned or otherwise.

A survey of DEC treatment and control customers shows that, among treatment group households:

- 94% recalled receiving at least one MyHER and 96% of those indicated that they "always" or "sometimes" read the reports.
- 77% reported being "very" or "somewhat" satisfied with information provided by MyHER.
- Around three-quarters of respondents give strong agreement ratings to the statements "I have learned about my household's energy use from My Home Energy Reports" and "I use the reports to tell me how well I am doing at saving energy." Very few (7%) agree strongly with the idea that the energy usage information presented by the reports is confusing.
- The most useful feature of the reports, as rated by treatment customer respondents, are the graphs that illustrate the home's energy usage over time. The least useful-rated feature are customized suggestions for the home.
- Most (72%) had no suggestions to improve the program. Those that did most frequently requested more specific or detailed information in their MyHERs.

In comparing responses of treatment and control group respondents, there were limited areas where treatment customers provided responses that more favorably reflected an increased awareness, engagement, or attitudes towards energy-savings opportunities and actions relative to control customers:

- Treatment group respondents reported slightly higher levels of satisfaction with the information Duke Energy makes available about energy efficiency programs, with information Duke Energy provides to help customers save on energy bills and Duke Energy's commitment to promoting energy efficiency and the wise use of electricity.

- Treatment group respondents reported higher levels overall satisfaction with Duke Energy as their electric service supplier: 75% of treatment customers gave a satisfaction score of 8 or higher (on a scale of 0 to 10), compared to 67% of control customers, a difference that is statistically significant at the 90% level of confidence.
- Treatment and control respondents reported very similar usage of the Duke Energy website to search for *other* information. However, treatment customers more significantly more likely to check website prior to major household purchase, where 38% of treatment customers report that they are likely to do so vs. 30% of control customers.
- Treatment and control customers report using similar strategies for tracking household energy use and report having taken similar energy saving actions.
- Similar portions of treatment and control respondents report having already completed certain energy-savings home upgrades, and similar portions of treatment and control respondents report intending to take those actions in the future.
- The vast majority, 93%, of treatment group customers say that “reducing their energy bills” is important to them, compared to 88% of control customers. Eighty-nine percent of treatment group respondents report that “setting an example for others” is important to them, compared to 54% of control customers. “Helping the environment” is important to 81% of treatment group respondents and is important to 74% of control respondents. All these differences are statistically significant, with at least 90% confidence.
- Treatment customers are more likely to rate themselves as “knowledgeable” about the different ways they can save energy in their home.

An index designed to account for overall survey-wide differences in response patterns between treatment and control customers did not find an overall more positive response pattern in simple frequencies. Across the 47 questions and sub-questions where treatment and control responses pertaining to attitudes, engagement, prior actions taken, intended future actions, and awareness, 24, or 51%, showed more favorable responses by treatment customers. While some areas such as attitudes and engagement showed increases for treatment customers, they were counteracted by no increases in the areas of actions taken and intended future actions.

5 Conclusions and Recommendations

Nexant found that the MyHER program is an effective channel for increasing customer engagement with energy efficiency and demand side management. The RCT program design facilitates reliable estimates of program energy savings. Further, the energy saving generated by the program are corroborated by survey findings of respondent engagement and focus on the importance of saving energy. As a valuable secondary benefit, Nexant found the MyHER is a useful tool for enhancing Duke Energy customer engagement and increases uptake in other Duke Energy efficiency programs. The MyHER program has achieved full deployment among Duke Energy's Carolinas customers and Nexant recommends that Duke Energy continue to focus on program processes and operations to further increase the efficiency of program delivery.

Additionally, Duke Energy launched the MyHER Interactive Portal in March, 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer. The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive also sends email challenges that seek to engage customer in active energy management, additional efficiency upgrades, and conservation behavior. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because the MyHER Interactive Portal was not deployed as a randomized, controlled trial (RCT).

5.1 Impact Findings

Nexant's impact findings result in an effective realization rate of 125%. This estimate increases the previously filed participant impact from 183.7 kWh to 229.8 kWh annually. Impact estimates account for the fact that MyHER increases uptake of other Duke Energy Carolinas programs. This finding subtracts 4.19 kWh annually from the average household impact of the MyHER program. The impact estimate also employs an "Intention to Treat" approach to account for the fact that program production timelines occasionally result in some homes temporarily not receiving a report. The time period of evaluated impacts is from May 2015 to April 2016. Nexant estimates the MyHER program saved a total of 251.2 GWh during this time period. The confidence and relative precision of this estimate is 90% and 6.5%, respectively.

For this evaluation period, the MyHER Interactive Portal savings estimates are too uncertain to determine whether the portal generates incremental savings above and beyond the standard MyHER paper edition. Although impact estimates are very uncertain, it would also be premature to draw the conclusion that MyHER Interactive is not working, and statistical models of monthly impact reflect some directional consistency.

5.2 Process Findings

The DEC MyHER program is Duke Energy's most mature behavioral program in terms of delivered energy savings. The large volume of data required to generate MyHER and support the program delivery schedule is the primary driver of program activities and focus. Duke Energy and its implementation contractor, Tendril, are successfully managing this process and providing DEC customers valuable information for managing home energy consumption.

The DEC MyHER program has benefited from a number of process and product management improvements that have enabled meeting and sometimes exceeding in-home date goals. These enhancements include speeding up the data transfer speed between Duke Energy and Tendril, increasing the frequency of report mailings from once per week to twice per week, and prioritizing major program changes and rollouts. Careful change management is a key enabler of maintaining a production process that consistently meets MyHER quality control standards.

The DEC MyHER program is delivered to more than one million residential customers in the Carolinas and is managed with high attention to quality and customer service. Appropriate staffing at Tendril to support the ongoing technical and data-centered quality control processes for report mailings is critical to success in this area. To date, the ability to continuously direct enough and appropriate Tendril resources to the project has been challenged at times, but with a small and very dedicated project team at Duke Energy, attention to potential risks to the successful operation of the program due to internal turnover or staffing outages should also be taken and mitigated as well.

MyHER participants have been found in this evaluation's customer surveys to be significantly more satisfied with Duke Energy as their electric service provider, when compared to control customers, which indicates success of a key program goal. However, the surveys also showed mixed findings with respect to whether or not the program broadly enhances customer motivation, awareness, attention, and effort in saving energy. Areas of strength for the program were found in the areas of treatment customers' relatively positive attitudes towards saving energy and engagement with Duke Energy in the area of energy efficiency.

5.3 Program Recommendations

- ***The inconsistent assignment of homes to the MyHER treatment and control group over time has complicated the intended RCT experimental design.*** This issue complicates the impact analysis and increases uncertainty in the impact estimates for cohort 4. In the future, homes should always be assigned to the treatment group with a corresponding assignment of homes to the control group. Assignment of new accounts to the MyHER treatment and control group should be limited to once or twice per year.
- ***Continue to monitor engagement and evaluate the impacts of the Interactive Portal.*** However, for this evaluation period, the MyHER Interactive Portal savings estimates are too uncertain to determine whether the portal generates incremental savings above and beyond the standard MyHER paper edition. Although impact estimates are very uncertain, it would also be premature to draw the conclusion that

MyHER Interactive is not working, and statistical models of monthly impact reflect some directional consistency.

- ***Continue to manage MyHER operations with an eye towards change management and prioritization of program changes.*** Challenges in quality control have historically followed on the heels of program changes and enhancements. Introduce changes slowly to consistently maintain a product that meets quality control standards and results in report cycles that pass quality assurance checks the first time.
- ***Prioritize appropriate project staffing.*** With MyHER's long, demanding, and ongoing production process, outages in appropriate staff can have implications for product quality and timely delivery. Outages and risk of outages of key project resources should be closely managed.

Appendix A Summary Form

MyHER Carolinas

Completed EMV Fact Sheet

Description of program

Duke Energy offers the My Home Energy Report (MyHER) to residential customers. MyHER relies on principles of behavioral science to encourage customer engagement with home energy management and energy efficiency. The program accomplishes this primarily by delivering a personalized report comparing each customer's energy use to a peer group of similar homes.

Date	June, 2015 – Dec., 2016
Region(s)	Carolinas
Evaluation Period	March, 2015 – February, 2016
Annual kWh Savings	251.2 GWh
Per Participant kWh Savings	229.8 kWh/home
Coincident kW Impact	0.0581 kW/home
Net-to-Gross Ratio	Not Applicable
Process Evaluation	Yes
Previous Evaluation(s)	2014

Evaluation Methodology

Impact Evaluation Activities

- *Eligible accounts are randomly assigned to either a treatment (participant) group or a control group. The control group accounts are not exposed to MyHER in order to provide the baseline for estimating savings attributable to the Home Energy Reports. In this randomized controlled trial (RCT) design, the only explanation for the observed differences in energy consumption between the treatment and control group is exposure to MyHER.*
- *The impact estimate is based on monthly billing data and program participation data provided by Duke Energy.*
- *The RCT delivery method of the program removes the need for a net-to-gross analysis as the billing analysis directly estimates the net impact of the program.*

Impact Evaluation Findings

- *Realization rate = 125% for energy impacts; 229.8 kWh per home*

Process Evaluation Activities

- *233 web surveys of treatment customers, 213 web surveys for control group customers and staff interviews.*

Process Evaluation Findings

- *Review and finalize any content that can be developed ahead of the monthly production schedule before the data transfers begin.*

Appendix B Measure Impact Results

Table 5-1: DSMore Measure Impact Results

Measure Category	Prod Code	State	Gross Energy Savings (kWh)	Gross Summer Coincident Demand (kW)	Gross Winter Coincident Demand (kW)	Net to Gross Ratio	Net Energy Savings (kWh)	Net Summer Coincident Demand (kW)	Net Winter Coincident Demand (kW)
NC_ My Home Energy Report	HCER	NC/SC	229.8	0.0581	N/A	100%	230	0.0581	N/A

Appendix C Survey Instruments

C.1 Treatment Households

Q1. First, we'd like to ask you about your overall opinion of Duke Energy. Please rate how satisfied you are with Duke Energy as your electric supplier.

Not at all Satisfied					Completely Satisfied					
0	1	2	3	4	5	6	7	8	9	10

Q2. We would also like to know how satisfied you are with several aspects of communication from Duke Energy. Please rate your overall satisfaction with each of the following.

	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied
The information available about Duke Energy's efficiency programs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy's commitment to promoting energy efficiency and the wise use of electricity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The information Duke Energy provides to help customers save on energy bills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3. When you log in to your Duke Energy account, which of the following have you done? Check all that apply.

- ☐ I have never logged in
- ☐ Pay my bill
- ☐ Review energy consumption graphs
- ☐ Look for energy efficiency opportunities or ideas
- ☐ None of the above

Q4. How often do you access the Duke Energy website to search for other information (for example: information about rebate programs, or how to make your home more energy efficient)? Select only one.

- ☐ Monthly
- ☐ Once a year
- ☐ A few times a year
- ☐ Never

Q5. If you needed to replace major home equipment or were considering improvements to your home's energy performance today, how likely would you be to check the Duke Energy website for information about energy efficient solutions or incentives?

Not at all Likely					Extremely Likely					
0	1	2	3	4	5	6	7	8	9	10

Q6. Over the past 12 months, have you taken any actions to reduce your household energy use?

- ☐ Yes
- ☐ No – Skip to Q8

Q7. What actions have you taken? Check all that apply.

- ☐ Adjust heating settings to save energy
- ☐ Adjust cooling settings to save energy
- ☐ Wash clothes in cold water
- ☐ Shut down household electronics when not in use
- ☐ Turn off lights in unused or outdoor areas
- ☐ Line dry washed clothing
- ☐ Other, please specify: _____
- ☐ Other, please specify: _____

Q8. In the next 12 months, how likely are you to make each of the following energy efficiency improvements?
Scale: 0 = Not at all Likely; 10 = Extremely Likely. If you have already made that improvement, check the "Already did it" box.

	Already did it	Not at all Likely										Extremely Likely
Install energy-efficient kitchen appliances	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Install energy-efficient heating/cooling system	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Install energy-efficient water heater	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Replace windows or doors	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Caulk or weatherstrip (windows or doors)	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Add insulation to attic, walls, or floors	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Contact a HVAC contractor for an estimate	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Request a home energy audit	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10

Q9. How important is it for you to know if your household is using energy wisely?

Not at all Important						Extremely Important					
0	1	2	3	4	5	6	7	8	9	10	

Q10. Which of the following do you do with regard to your household's energy use? Check all that apply.

- ☐ Track monthly energy use
- ☐ Track the total amount of your bill
- ☐ Compare usage to previous months
- ☐ Compare usage to the same month from last year
- ☐ None of the above

Q11. How would you rate your knowledge of the different ways you can save energy in your home?

Not at all Knowledgeable						Extremely Knowledgeable					
0	1	2	3	4	5	6	7	8	9	10	

Q12. Duke Energy sends a personalized report called *My Home Energy Report* to a select group of homes. These documents are mailed in a standard envelope every few months and provide customers with information on how their home's electric energy usage compares with similar homes. Have you seen one of these reports?

☐ Yes ☐ No – **Skip to Q21**

Q13. About how many *My Home Energy Reports* have you received in the past 12 months? _____ **If zero, skip to Q21**

Q14. How often do you read the *My Home Energy Reports*?

☐ Always ☐ Sometimes ☐ Never – **Skip to Q21**

Q15. Please indicate how much you agree or disagree with the following statements about *My Home Energy Reports*. Scale: 0 = Strongly Disagree; 10 = Strongly Agree

	Strongly Disagree										Strongly Agree									
I have learned about my household's energy use from <i>My Home Energy Reports</i> .	0	1	2	3	4	5	6	7	8	9	10									
I use the reports to tell me how well I am doing at saving energy.	0	1	2	3	4	5	6	7	8	9	10									
The tips provided in the reports are pertinent to my home.	0	1	2	3	4	5	6	7	8	9	10									
I'd like more detailed information about my home's energy use.	0	1	2	3	4	5	6	7	8	9	10									
I have discussed <i>My Home Energy Reports</i> with others.	0	1	2	3	4	5	6	7	8	9	10									
The information provided about my home's energy use is confusing.	0	1	2	3	4	5	6	7	8	9	10									

Q16. How could Duke Energy make *My Home Energy Reports* more useful for your household? Please provide any suggestions you may have to improve the reports.

Q17. Do you recall any specific tips or information from the *My Home Energy Reports*?

☐ Yes ☐ No – **Skip to Q19**

Q18. What specific tips do you recall?

Q20. Please rate your satisfaction with the information in the *My Home Energy Reports* you've received.

- ☐ Very Satisfied
☐ Somewhat Satisfied
☐ Neither Satisfied nor Dissatisfied
☐ Somewhat Dissatisfied
☐ Very Dissatisfied

Q20a. Why do you say that? _____

Q21. The statements below provide reasons why households might try to reduce their home's energy use. Please indicate how important each statement is to you. Scale: 0 = Not at all Important; 10 = Extremely Important

	Not at all Important					Extremely Important						
	0	1	2	3	4	5	6	7	8	9	10	
Reducing my energy bill(s)	0	1	2	3	4	5	6	7	8	9	10	
Using less energy	0	1	2	3	4	5	6	7	8	9	10	
Helping the environment	0	1	2	3	4	5	6	7	8	9	10	
Setting an example for others	0	1	2	3	4	5	6	7	8	9	10	
Avoiding waste	0	1	2	3	4	5	6	7	8	9	10	

Q22. Please indicate your level of agreement with each of the following statements:

	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree
Duke Energy provides excellent customer service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy respects its customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy provides service at a reasonable cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

We would like to understand the lighting products customers in the Carolinas are using.

Q23a. About how many light bulbs are installed in your home? (Some fixtures contain multiple bulbs.) _____

Q23b. About how many CFLs are installed in your home? Compact fluorescent light bulbs, or CFLs, are small fluorescent bulbs that fit in regular light bulb sockets. They are often made out of thin tubes of twisted glass. _____

Q23c. About how many LED bulbs are installed in your home? LED light bulbs also fit in regular light bulb sockets. They produce light using semiconductor chips and use a lot less energy than incandescent bulbs. _____

Q24. Do you own or rent this residence? ☐ Own ☐ Rent

Q25. Including yourself, how many people live in your home? _____

Q26. In what year was your home built? _____

Q27. How many square feet is the above-ground living space? _____

Q28. What is your primary heating fuel? ☐ Electricity ☐ Natural Gas ☐ Oil ☐ Other

Q29. In what year were you born? _____

C.2 Control Households

Q1. First, we'd like to ask you about your overall opinion of Duke Energy. Please rate how satisfied you are with Duke Energy as your electric supplier.

Not at all Satisfied					Completely Satisfied					
0	1	2	3	4	5	6	7	8	9	10

Q2. We would also like to know how satisfied you are with several aspects of communication from Duke Energy. Please rate your overall satisfaction with each of the following.

	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied
The information available about Duke Energy's efficiency programs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy's commitment to promoting energy efficiency and the wise use of electricity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The information Duke Energy provides to help customers save on energy bills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3. When you log in to your Duke Energy account, which of the following have you done? Check all that apply.

- ☐ I have never logged in
- ☐ Pay my bill
- ☐ Review energy consumption graphs
- ☐ Look for energy efficiency opportunities or ideas
- ☐ None of the above

Q4. How often do you access the Duke Energy website to search for other information (for example: information about rebate programs, or how to make your home more energy efficient)? Select only one.

- ☐ Monthly
- ☐ A few times a year
- ☐ Once a year
- ☐ Never

Q5. If you needed to replace major home equipment or were considering improvements to your home's energy performance today, how likely would you be to check the Duke Energy website for information about energy efficient solutions or incentives?

Not at all Likely					Extremely Likely					
0	1	2	3	4	5	6	7	8	9	10

Q6. Over the past 12 months, have you taken any actions to reduce your household energy use?

- ☐ Yes
- ☐ No – **Skip to Q8**

Q7. What actions have you taken? Check all that apply.

- ☐ Adjust heating settings to save energy
- ☐ Adjust cooling settings to save energy
- ☐ Wash clothes in cold water
- ☐ Shut down household electronics when not in use
- ☐ Turn off lights in unused or outdoor areas
- ☐ Line dry washed clothing
- ☐ Other, please specify: _____
- ☐ Other, please specify: _____

Q8. In the next 12 months, how likely are you to make each of the following energy efficiency improvements? Scale: 0 = Not at all Likely; 10 = Extremely Likely. If you have already made that improvement, check the "Already did it" box.

	Already did it	Not at all Likely										Extremely Likely
Install energy-efficient kitchen appliances	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Install energy-efficient heating/cooling system	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Install energy-efficient water heater	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Replace windows or doors	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Caulk or weatherstrip (windows or doors)	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Add insulation to attic, walls, or floors	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Contact a HVAC contractor for an estimate	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10
Request a home energy audit	<input type="checkbox"/>	0	1	2	3	4	5	6	7	8	9	10

Q9. How important is it for you to know if your household is using energy wisely?

Not at all Important								Extremely Important		
0	1	2	3	4	5	6	7	8	9	10

Q10. Which of the following do you do with regard to your household's energy use? Check all that apply.

- ☐ Track monthly energy use
- ☐ Track the total amount of your bill
- ☐ Compare usage to previous months
- ☐ Compare usage to the same month from last year
- ☐ None of the above

Q11. How would you rate your knowledge of the different ways you can save energy in your home?

Not at all Knowledgeable								Extremely Knowledgeable		
0	1	2	3	4	5	6	7	8	9	10

Q12. Thinking about the information you have about your home's energy use, please rate how useful each of the following items would be for your household. Scale: 0 = Not at all Useful; 10 = Extremely Useful

	Not at all Useful										Extremely Useful
Your home's energy use compared to that of similar homes	0	1	2	3	4	5	6	7	8	9	10
Tips to help you save money and energy	0	1	2	3	4	5	6	7	8	9	10
Examples of the energy use associated with common household items	0	1	2	3	4	5	6	7	8	9	10
Customized suggestions for your home	0	1	2	3	4	5	6	7	8	9	10
Graphs that illustrate your home's energy use over time	0	1	2	3	4	5	6	7	8	9	10
Information about services and offers from Duke Energy	0	1	2	3	4	5	6	7	8	9	10

Q13. The statements below provide reasons why households might try to reduce their home's energy use. Please indicate how important each statement is to you. Scale: 0 = Not at all Important; 10 = Extremely Important

	Not at all Important										Extremely Important
Reducing my energy bill(s)	0	1	2	3	4	5	6	7	8	9	10
Using less energy	0	1	2	3	4	5	6	7	8	9	10
Helping the environment	0	1	2	3	4	5	6	7	8	9	10
Setting an example for others	0	1	2	3	4	5	6	7	8	9	10
Avoiding waste	0	1	2	3	4	5	6	7	8	9	10

Q14. Please indicate your level of agreement with each of the following statements:

	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree
Duke Energy provides excellent customer service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy respects its customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duke Energy provides service at a reasonable cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

We would like to understand the lighting products customers in the Carolinas are using.

Q15a. About how many light bulbs are installed in your home? (Some fixtures contain multiple bulbs.) _____

Q15b. About how many CFLs are installed in your home? Compact fluorescent light bulbs, or CFLs, are small fluorescent bulbs that fit in regular light bulb sockets. They are often made out of thin tubes of twisted glass. _____

Q15c. About how many LED bulbs are installed in your home? LED light bulbs also fit in regular light bulb sockets. They produce light using semiconductor chips and use a lot less energy than incandescent bulbs. _____

- Q16. Do you own or rent this residence? ☐ Own ☐ Rent
- Q17. Including yourself, how many people live in your home? _____
- Q18. In what year was your home built? _____
- Q19. How many square feet is the above-ground living space? _____
- Q20. What is your primary heating fuel? ☐ Electricity ☐ Natural Gas ☐ Oil ☐ Other
- Q21. In what year were you born? _____

Thank you! Please return your completed survey using the enclosed envelope.

Appendix D Survey Frequencies: DEC

Q1 *First, we'd like to ask you about your overall opinion of Duke Energy. Please rate how satisfied you are with Duke Energy as your electric supplier.*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	1	2	5	0	5	18	11	34	44	35	77	1	233
Percent	0	1	2	0	2	8	5	15	19	15	33	0	100
Treatment	1	2	2	2	3	9	11	23	45	50	61	4	213
Percent	0	1	1	1	1	4	5	11	21	23	29	2	100
Total	2	4	7	2	8	27	22	57	89	85	138	5	446
Percent	0	1	2	0	2	6	5	13	20	19	31	1	100

Q2 *We would also like to know how satisfied you are with several aspects of communication from Duke Energy. Please rate your overall satisfaction with each of the following.*

Q2_r1 *The information available about Duke Energy's efficiency programs*

Group	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied	Don't Know	Total
Control	83	74	32	11	22	11	233
Percent	36	32	14	5	9	5	100
Treatment	84	72	30	4	18	5	213
Percent	39	34	14	2	8	2	100
Total	167	146	62	15	40	16	446
Percent	37	33	14	3	9	4	100

Q2_r2 *Duke Energy's commitment to promoting energy efficiency and the wise use of electricity*

Group	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied	Don't Know	Total
Control	90	70	30	14	20	9	233
Percent	39	30	13	6	9	4	100
Treatment	84	75	24	6	18	6	213
Percent	39	35	11	3	8	3	100
Total	174	145	54	20	38	15	446
Percent	39	33	12	4	9	3	100

Q2_r3 The information Duke Energy provides to help customers save on energy bills

Group	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied	Don't Know	Total
Control	81	82	30	10	22	8	233
Percent	35	35	13	4	9	3	100
Treatment	84	72	24	6	22	5	213
Percent	39	34	11	3	10	2	100
Total	165	154	54	16	44	13	446
Percent	37	35	12	4	10	3	100

Q3 When you log in to your Duke Energy account, which of the following have you done? Check all that apply.

Q3_1 I have never logged in

Group	I Have Never Logged In	I logged In	Total
Control	120	113	233
Percent	52	49	100
Treatment	109	104	213
Percent	51	49	100
Total	229	217	446
Percent	51	49	100

Q3_2 Paid my bill

Group	No	Yes	Total
Control	157	76	233
Percent	67	33	100
Treatment	146	67	213
Percent	69	31	100
Total	303	143	446
Percent	68	32	100

Q3_3 Reviewed energy consumption graphs

Group	No	Yes	Total
Control	193	40	233
Percent	83	17	100
Treatment	177	36	213
Percent	83	17	100
Total	370	76	446
Percent	83	17	100

Q3_4 Looked for energy efficiency opportunities or ideas

Group	No	Yes	Total
Control	208	25	233
Percent	89	11	100
Treatment	185	28	213
Percent	87	13	100
Total	393	53	446
Percent	88	12	100

Q3_5 None of the above

Group	No	Yes	Total
Control	210	23	233
percent	90	10	100
Treatment	193	20	213
Percent	91	9	100
Total	403	43	446
Percent	90	10	100

Q4 How often do you access the Duke Energy website to search for other information (for example: information about rebate programs, or how to make your home more energy efficient)? Select only one.

Group	Monthly	A Few Times a Year	Once a Year	Never	Total
Control	18	34	21	160	233
Percent	8	15	9	69	100
Treatment	15	33	25	140	213
Percent	7	15	12	66	100
Total	33	67	46	300	446
Percent	7	15	10	67	100

Q5 *If you needed to replace major home equipment or were considering improvements to your home's energy performance today, how likely would you be to check the Duke Energy website for information about energy efficient solutions or incentives?*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	51	14	11	19	13	27	20	17	10	11	28	12	233
Percent	22	6	5	8	6	12	9	7	4	5	12	5	100
Treatment	38	12	13	10	10	23	19	15	21	16	25	11	213
Percent	18	6	6	5	5	11	9	7	10	8	12	5	100
Total	89	26	24	29	23	50	39	32	31	27	53	23	446
Percent	20	6	5	7	5	11	9	7	7	6	12	5	100

Q6 *Over the past 12 months, have you taken any actions to reduce your household energy use?*

Group	No	Yes	Total
Control	51	182	233
Percent	22	78	100
Treatment	44	169	213
Percent	21	79	100
Total	95	351	446
Percent	21	79	100

Q7 *What actions have you taken? Check all that apply.*

Q7_1 *Adjusted heating settings to save energy*

Group	No	Yes	Missing	Total
Control	60	122	51	233
Percent	26	52	22	100
Treatment	59	110	44	213
Percent	28	52	21	100
Total	119	232	95	446
Percent	27	52	21	100

Q7_2 Adjust cooling settings to save energy

Group	No	Yes	Missing	Total
Control	31	151	51	233
Percent	13	65	22	100
Treatment	38	131	44	213
Percent	18	62	21	100
Total	69	282	95	446
Percent	15	63	21	100

Q7_3 Wash clothes in cold water

Group	No	Yes	Missing	Total
Control	78	104	51	233
Percent	33	45	22	100
Treatment	79	90	44	213
Percent	37	42	21	100
Total	157	194	95	446
Percent	35	44	21	100

Q7_4 Shut down household electronics when not in use

Group	No	Yes	Missing	Total
Control	73	109	51	233
Percent	31	47	22	100
Treatment	71	98	44	213
Percent	33	46	21	100
Total	144	207	95	446
Percent	32	46	21	100

Q7_5 Turn off lights in unused or outdoor areas

Group	No	Yes	Missing	Total
Control	26	156	51	233
Percent	11	67	22	100
Treatment	29	140	44	213
Percent	14	66	21	100
Total	55	296	95	446
Percent	12	66	21	100

Q7_6 Line dry washed clothing

Group	No	Yes	Missing	Total
Control	153	29	51	233
Percent	66	12	22	100
Treatment	139	30	44	213
Percent	65	14	21	100
Total	292	59	95	446
Percent	65	13	21	100

Q7_7 Other

Group	No	Yes	Missing	Total
Control	134	48	51	233
Percent	58	21	22	100
Treatment	113	56	44	213
Percent	53	26	21	100
Total	247	104	95	446
Percent	55	23	21	100

Q7_8 Other

Group	No	Yes	Missing	Total
Control	175	7	51	233
Percent	75	3	22	100
Treatment	159	10	44	213
Percent	75	5	21	100
Total	334	17	95	446
Percent	75	4	21	100

Q8. In the next 12 months, how likely are you to make each of the following energy efficiency improvements? Scale: 0 = Not at all Likely; 10 = Extremely Likely. If you have already made that improvement, check the “Already did it” box.

Q8_r1 Install energy efficient kitchen appliances

Group	Already Did it	Did Not Do it	Total
Control	63	170	233
Percent	27	73	100
Treatment	59	154	213
Percent	28	72	100
Total	122	324	446
Percent	27	73	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	89	16	6	3	2	12	5	11	5	3	15	66	233
Percent	38	7	3	1	1	5	2	5	2	1	6	28	100
Treatment	85	14	3	5	2	19	5	7	12	2	11	48	213
Percent	40	7	1	2	1	9	2	3	6	1	5	23	100
Total	174	30	9	8	4	31	10	18	17	5	26	114	446
Percent	39	7	2	2	1	7	2	4	4	1	6	26	100

Q8_r2 Install energy-efficient heating/cooling system

Group	Already Did It	Did Not Do It	Total
Control	69	164	233
Percent	30	70	100
Treatment	56	157	213
Percent	26	74	100
Total	125	321	446
Percent	28	72	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	92	14	7	3	3	11	4	6	9	3	15	66	233
Percent	39	6	3	1	1	5	2	3	4	1	6	28	100
Treatment	94	14	6	7	1	15	4	7	5	1	11	48	213
Percent	44	7	3	3	0	7	2	3	2	0	5	23	100
Total	186	28	13	10	4	26	8	13	14	4	26	114	446
Percent	42	6	3	2	1	6	2	3	3	1	6	26	100

Q8_r3 Install energy-efficient water heater

Group	Already Did It	Haven't Done It	Total
Control	61	172	233
Percent	26	74	100
Treatment	60	153	213
Percent	28	72	100
Total	121	325	446
Percent	27	73	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	93	18	5	6	5	9	5	2	10	1	22	57	233
Percent	40	8	2	3	2	4	2	1	4	0	9	24	100
Treatment	91	17	5	5	0	16	5	8	2	3	13	48	213
Percent	43	8	2	2	0	8	2	4	1	1	6	23	100
Total	184	35	10	11	5	25	10	10	12	4	35	105	446
Percent	41	8	2	2	1	6	2	2	3	1	8	24	100

Q8_r4 Replace windows or doors

Group	Already Did It	Haven't Done It	Total
Control	48	185	233
Percent	21	79	100
Treatment	47	166	213
Percent	22	78	100
Total	95	351	446
Percent	21	79	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	110	16	8	4	5	7	4	2	8	4	17	48	233
Percent	47	7	3	2	2	3	2	1	3	2	7	21	100
Treatment	105	18	7	3	4	10	3	5	5	3	9	41	213
Percent	49	8	3	1	2	5	1	2	2	1	4	19	100
Total	215	34	15	7	9	17	7	7	13	7	26	89	446
Percent	48	8	3	2	2	4	2	2	3	2	6	20	100

Q8_r5 Caulk or weatherstrip (windows or doors)

Group	Already Did It	Haven't Done It	Total
Control	55	178	233
Percent	24	76	100
Treatment	49	164	213
Percent	23	77	100
Total	104	342	446
Percent	23	77	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	71	14	9	6	6	18	7	10	9	9	23	51	233
Percent	30	6	4	3	3	8	3	4	4	4	10	22	100
Treatment	66	15	7	5	4	20	6	8	14	4	20	44	213
Percent	31	7	3	2	2	9	3	4	7	2	9	21	100
Total	137	29	16	11	10	38	13	18	23	13	43	95	446
Percent	31	7	4	2	2	9	3	4	5	3	10	21	100

Q8_r6 Add insulation to attic, walls, or floors

Group	Already Did It	Haven't Done It	Total
Control	48	185	233
Percent	21	79	100
Treatment	50	163	213
Percent	23	77	100
Total	98	348	446
Percent	22	78	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	113	15	6	3	7	8	4	7	6	2	11	51	233
Percent	49	6	3	1	3	3	2	3	3	1	5	22	100
Treatment	96	13	7	4	5	13	7	7	3	5	11	42	213
Percent	45	6	3	2	2	6	3	3	1	2	5	20	100
Total	209	28	13	7	12	21	11	14	9	7	22	93	446
Percent	47	6	3	2	3	5	2	3	2	2	5	21	100

Q8_r7 Contact a HVAC contractor for an estimate

Group	Already Did It	Haven't Done It	Total
Control	15	218	233
Percent	6	94	100
Treatment	19	194	213
Percent	9	91	100
Total	34	412	446
Percent	8	92	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	136	14	8	3	5	5	3	6	4	3	9	37	233
Percent	58	6	3	1	2	2	1	3	2	1	4	16	100
Treatment	117	20	4	6	1	12	3	4	1	2	6	37	213
Percent	55	9	2	3	0	6	1	2	0	1	3	17	100
Total	253	34	12	9	6	17	6	10	5	5	15	74	446
Percent	57	8	3	2	1	4	1	2	1	1	3	17	100

Q8_r8 Request a home energy audit

Group	Already Did It	Haven't Done It	Total
Control	9	224	233
Percent	4	96	100
Treatment	13	200	213
Percent	6	94	100
Total	22	424	446
Percent	5	95	100

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	124	21	7	7	4	16	4	2	4	3	12	29	233
Percent	53	9	3	3	2	7	2	1	2	1	5	12	100
Treatment	115	17	6	7	0	12	6	4	4	1	6	35	213
Percent	54	8	3	3	0	6	3	2	2	0	3	16	100
Total	239	38	13	14	4	28	10	6	8	4	18	64	446
Percent	54	9	3	3	1	6	2	1	2	1	4	14	100

Q9 How important is it for you to know if your household is using energy wisely?

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	4	1	5	8	5	19	19	35	43	18	73	3	233
Percent	2	0	2	3	2	8	8	15	18	8	31	1	100
Treatment	4	1	1	5	6	18	14	23	27	27	86	1	213
Percent	2	0	0	2	3	8	7	11	13	13	40	0	100
Total	8	2	6	13	11	37	33	58	70	45	159	4	446
Percent	2	0	1	3	2	8	7	13	16	10	36	1	100

Q10 Which of the following do you do with regard to your household's energy use?
Check all that apply.

Q10_1 Track monthly energy use

Group	No	Yes	Total
Control	138	95	233
Percent	59	41	100
Treatment	115	98	213
Percent	54	46	100
Total	253	193	446
Percent	57	43	100

Q10_2 Track the total amount of your bill

Group	No	Yes	Total
Control	77	156	233
Percent	33	67	100
Treatment	71	142	213
Percent	33	67	100
Total	148	298	446
Percent	33	67	100

Q10_3 Compare usage to previous months

Group	No	Yes	Total
Control	77	156	233
Percent	33	67	100
Treatment	74	139	213
Percent	35	65	100
Total	151	295	446
Percent	34	66	100

Q10_4 Compare usage to the same month from last year

Group	No	Yes	Total
Control	106	127	233
Percent	45	55	100
Treatment	96	117	213
Percent	45	55	100
Total	202	244	446
Percent	45	55	100

Q10_5 None of the above

Group	No	Yes	Total
Control	211	22	233
Percent	91	9	100
Treatment	193	20	213
Percent	91	9	100
Total	404	42	446
Percent	91	9	100

Q10_6 Don't know

Group	Know	Don't Know	Total
Control	230	3	233
Percent	99	1	100
Treatment	212	1	213
Percent	100	0	100
Total	442	4	446
Percent	99	1	100

Q11 How would you rate your knowledge of the different ways you can save energy in your home?

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	6	6	9	12	8	43	29	32	43	23	19	3	233
Percent	3	3	4	5	3	18	12	14	18	10	8	1	100
Treat	6	2	4	10	5	22	29	38	43	27	25	2	213
Percent	3	1	2	5	2	10	14	18	20	13	12	1	100
Total	12	8	13	22	13	65	58	70	86	50	44	5	446
Percent	3	2	3	5	3	15	13	16	19	11	10	1	100

Q12 Duke Energy sends a personalized report called My Home Energy Report to a select group of homes. These documents are mailed in a standard envelope every few months and provide customers with information on how their home's electric energy usage compares with similar homes. Have you seen one of these reports? (Only for treatment group)

Group	Yes	No	Total
Treatment	201	12	213
Percent	94	6	100

Q13 About how many My Home Energy Reports have you received in the past 12 months? (Only for treatment group)

Group	1	2	3	4	5	6	7	8	9	10	11	12	Don't Know	Missing	Total
Treatment	1	10	10	20	7	27	3	12	1	4	1	46	59	12	213
Percent	0	5	5	9	3	13	1	6	0	2	0	22	28	6	100

Q14 How often do you read the My Home Energy Reports? (Only for treatment group)

Group	Always	Sometimes	Never	Missing	Total
Treatment	143	50	8	12	213
percent	67	23	4	6	100

Q15 Please indicate how much you agree or disagree with the following statements about My Home Energy Reports. Scale: 0 = Strongly Disagree; 10 = Strongly Agree (Only for treatment group)

Q15_r1 I have learned about my household's energy use from My Home Energy Reports

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	6	4	5	3	2	13	12	21	22	25	75	5	20	213
Percent	3	2	2	1	1	6	6	10	10	12	35	2	9	100

Q15_r2 I use the reports to tell me how well I am doing at saving energy

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	6	6	7	3	4	13	14	14	26	24	70	6	20	213
Percent	3	3	3	1	2	6	7	7	12	11	33	3	9	100

Q15_r3 The tips provided in the reports are pertinent to my home

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	9	7	6	9	6	23	15	17	28	24	41	8	20	213
Percent	4	3	3	4	3	11	7	8	13	11	19	4	9	100

Q15_r4 *I'd like more detailed information about my home's energy use*

Group	0	1	2	3	4	5	6	7	8	9	10	Don'tKknow	Missing	Total
Treatment	15	15	14	7	9	24	17	12	17	14	39	10	20	213
Percent	7	7	7	3	4	11	8	6	8	7	18	5	9	100

Q15_r5 *I have discussed My Home Energy Reports with others*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	47	26	13	1	5	17	7	8	12	14	32	11	20	213
Percent	22	12	6	0	2	8	3	4	6	7	15	5	9	100

Q15_r6 *The information provided about my home's energy use is confusing*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	82	28	16	11	6	22	6	3	4	2	3	10	20	213
Percent	39	13	8	5	3	10	3	1	2	1	1	5	9	100

Q17 *Do you recall any specific tips or information from the My Home Energy Reports?
(Only for treatment group)*

Group	Yes	No	Missing	Total
Treatment	76	117	20	213
Percent	36	55	9	100

Q19T *Below is a list of My Home Energy Report features. Please rate how useful each feature is to you.
Scale: 0 = Not at all Useful; 10 = Extremely Useful (for treatment group)*

Q19T_r1 *Comparison to similar homes*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	17	6	6	5	5	19	4	10	32	18	58	13	20	213
Percent	8	3	3	2	2	9	2	5	15	8	27	6	9	100

Q19T_r2 *Tips to help you save money and energy*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	5	7	4	6	8	16	12	16	30	29	52	8	20	213
Percent	2	3	2	3	4	8	6	8	14	14	24	4	9	100

Q19T_r3 *Examples of the energy use associated with common household items*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	9	5	5	7	7	16	8	15	38	19	52	12	20	213
Percent	4	2	2	3	3	8	4	7	18	9	24	6	9	100

Q19T_r4 *Customized suggestions for your home*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	10	6	11	6	6	23	13	12	32	17	47	10	20	213
Percent	5	3	5	3	3	11	6	6	15	8	22	5	9	100

Q19T_r5 *Graphs that illustrate your home's energy use over time*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	8	4	5	2	7	12	5	15	25	28	72	10	20	213
Percent	4	2	2	1	3	6	2	7	12	13	34	5	9	100

Q19T_r6 *Information about services and offers from Duke Energy*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Treatment	11	6	9	3	11	16	11	16	30	20	50	10	20	213
Percent	5	3	4	1	5	8	5	8	14	9	23	5	9	100

Q19C *Thinking about the information you have about your home's energy use, please rate how useful each of the following items would be for your household. Scale: 0 = Not at all Useful; 10 = Extremely (Modified question – asked only of control group, not treatment.)*

Q19C_r1 *Your home's energy use compared to that of similar homes*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	36	11	10	6	5	27	18	26	29	13	38	14	0	233
Percent	15	5	4	3	2	12	8	11	12	6	16	6	0	100

Q19C_r2 *Tips to help you save money and energy*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	13	8	5	5	1	25	19	29	37	17	65	9	0	233
Percent	6	3	2	2	0	11	8	12	16	7	28	4	0	100

Q19C_r3 *Examples of the energy use associated with common household items*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	15	5	8	8	5	29	14	28	44	17	47	13	0	233
Percent	6	2	3	3	2	12	6	12	19	7	20	6	0	100

Q19C_r4 *Customized suggestions for your home*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	22	13	13	5	6	22	20	14	40	16	45	17	0	233
Percent	9	6	6	2	3	9	9	6	17	7	19	7	0	100

Q19C_r5 *Graphs that illustrate your home's energy use over time*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	23	6	5	7	4	25	17	18	38	18	56	16	0	233
Percent	10	3	2	3	2	11	7	8	16	8	24	7	0	100

Q19C_r6 *Information about services and offers from Duke Energy*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Missing	Total
Control	14	11	7	9	6	27	17	23	34	21	50	14	0	233
Percent	6	5	3	4	3	12	7	10	15	9	21	6	0	100

Q20 *Please rate your satisfaction with the information in the My Home Energy Reports you've received (Only for treatment group)*

Group	Very Satisfied	Somewhat Satisfied	Neither Satisfied nor Dissatisfied	Somewhat Dissatisfied	Very Dissatisfied	Don't Know	Missing	Total
Treatment	87	60	33	6	4	3	20	213
Percent	41	28	15	3	2	1	9	100

Q21 The statements below provide reasons why households might try to reduce their home's energy use. Please indicate how important each statement is to you. Scale: 0 = Not at all Important; 10 = Extremely Important

Q21_r1 Reducing my energy bill(s)

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	5	2	4	3	1	11	3	17	26	28	130	3	233
Percent	2	1	2	1	0	5	1	7	11	12	56	1	100
Treatment	1	1	0	1	3	4	5	11	14	34	137	2	213
Percent	0	0	0	0	1	2	2	5	7	16	64	1	100
Total	6	3	4	4	4	15	8	28	40	62	267	5	446
Percent	1	1	1	1	1	3	2	6	9	14	60	1	100

Q21_r2 Using less energy

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	5	2	6	5	3	17	10	21	32	24	105	3	233
Percent	2	1	3	2	1	7	4	9	14	10	45	1	100
Treatment	3	5	1	0	2	14	7	11	24	35	107	4	213
Percent	1	2	0	0	1	7	3	5	11	16	50	2	100
Total	8	7	7	5	5	31	17	32	56	59	212	7	446
Percent	2	2	2	1	1	7	4	7	13	13	48	2	100

Q21_r3 Helping the environment

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	7	4	8	4	3	20	10	22	21	23	100	11	233
Percent	3	2	3	2	1	9	4	9	9	10	43	5	100
Treat	6	3	1	3	2	12	11	19	27	31	91	7	213
Percent	3	1	0	1	1	6	5	9	13	15	43	3	100
Total	13	7	9	7	5	32	21	41	48	54	191	18	446
Percent	3	2	2	2	1	7	5	9	11	12	43	4	100

Q21_r4 *Setting an example for others*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	31	11	5	9	9	29	8	19	22	12	67	11	233
Percent	13	5	2	4	4	12	3	8	9	5	29	5	100
Treat	18	11	8	3	7	20	7	12	28	22	69	8	213
Percent	8	5	4	1	3	9	3	6	13	10	32	4	100
Total	49	22	13	12	16	49	15	31	50	34	136	19	446
Percent	11	5	3	3	4	11	3	7	11	8	30	4	100

Q21_r5 *Avoiding waste*

Group	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total
Control	8	5	3	6	2	15	9	15	39	23	102	6	233
Percent	3	2	1	3	1	6	4	6	17	10	44	3	100
Treatment	3	5	1	2	1	13	8	12	21	35	109	3	213
Percent	1	2	0	1	0	6	4	6	10	16	51	1	100
Total	11	10	4	8	3	28	17	27	60	58	211	9	446
Percent	2	2	1	2	1	6	4	6	13	13	47	2	100

Q22 *Please indicate your level of agreement with each of the following statements:*

Q22_r1 *Duke Energy provides excellent customer service*

Group	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	Don't Know	Total
Control	3	9	24	78	112	7	233
Percent	1	4	10	33	48	3	100
Treatment	7	7	19	72	99	9	213
Percent	3	3	9	34	46	4	100
Total	10	16	43	150	211	16	446
Percent	2	4	10	34	47	4	100

Q22_r2 Duke Energy respects its customers

Group	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	Don't Know	Total
Control	7	10	22	80	110	4	233
Percent	3	4	9	34	47	2	100
Treatment	9	9	23	61	95	16	213
Percent	4	4	11	29	45	8	100
Total	16	19	45	141	205	20	446
Percent	4	4	10	32	46	4	100

Q22_r3 Duke Energy provides service at a reasonable cost

Group	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	Don't Know	Total
Control	8	26	37	90	63	9	233
Percent	3	11	16	39	27	4	100
Treatment	12	29	33	76	49	14	213
Percent	6	14	15	36	23	7	100
Total	20	55	70	166	112	23	446
Percent	4	12	16	37	25	5	100

Q24 Do you own or rent this residence?

Group	Own	Rent	Prefer Not To Answer	Total
Control	208	21	4	233
Percent	89	9	2	100
Treatment	195	12	6	213
Percent	92	6	3	100
Total	403	33	10	446
Percent	90	7	2	100

Q25 Including yourself, how many people live in your home?

Group	1	2	3	4	5	6	7	10	12	Prefer Not To Answer	Total
Control	49	86	40	33	9	2	2	1	1	10	233
Percent	21	37	17	14	4	1	1	0	0	4	100
Treatment	37	82	41	20	9	5	2	0	0	17	213
Percent	17	39	19	9	4	2	1	0	0	8	100
Total	86	168	81	53	18	7	4	1	1	27	446
Percent	19	38	18	12	4	2	1	0	0	6	100

Q28 *What is your primary heating fuel?*

Group	Electricity	Natural Gas	Oil	Other	Don't Know	Prefer Not To Answer	Total
Control	122	85	6	16	1	3	233
Percent	52	36	3	7	0	1	100
Treatment	112	83	5	10	1	2	213
Percent	53	39	2	5	0	1	100
Total	234	168	11	26	2	5	446
Percent	52	38	2	6	0	1	100

Appendix E Detailed Regression Outputs/Models

Table 5-2: Regression Coefficients for Cohort 1

Linear regression, absorbing indicators	Number of obs	=	111,294
	F(12,16377)	=	1,264
	Prob > F	=	0.000
	R-squared	=	0.8788
	Adj R-squared	=	0.8578
	Root MSE	=	10.7168

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
612	-1.19862	0.1261584	-9.5	0	-1.4459	-0.95133
624	-13.2464	0.1710114	-77.46	0	-13.5816	-12.9112
636	-12.3061	0.1747251	-70.43	0	-12.6485	-11.9636
648	-3.04992	0.1677605	-18.18	0	-3.37875	-2.72109
660	-8.82232	0.1785249	-49.42	0	-9.17225	-8.47239
672	-11.241	0.1923441	-58.44	0	-11.618	-10.864
bill_mo#c.treatment						
600	0	(empty)				
612	-0.35623	0.2038147	-1.75	0.081	-0.75573	0.04327
624	-0.62072	0.2755296	-0.75	0.024	-1.16079	-0.08065
636	-0.66647	0.2805526	0.25	0.018	-1.21639	-0.11656
648	-0.71835	0.272195	1.25	0.008	-1.25188	-0.18482
660	-0.76798	0.2904043	2.25	0.008	-1.3372	-0.19875
672	-0.71759	0.3095764	3.25	0.02	-1.32439	-0.11079
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateogreis - Redundant					
account_id	0 16378 16378 *					

Linear regression, absorbing indicators	Number of obs	=	112,704
	F(12,16423)	=	1,264
	Prob > F	=	0.000
	R-squared	=	0.8753
	Adj R-squared	=	0.854
	Root MSE	=	10.2142

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
613	-9.66312	0.1424374	-67.84	0	-9.94231	-9.38392
625	-13.0682	0.1644882	-79.45	0	-13.3906	-12.7458
637	-7.17262	0.1585145	-45.25	0	-7.48332	-6.86191
649	-5.18122	0.1645818	-31.48	0	-5.50381	-4.85862
661	-4.18229	0.1713522	-24.41	0	-4.51815	-3.84642
673	-9.73533	0.1837813	-52.97	0	-10.0956	-9.3751
bill_mo#c.treatment						
601	0	(empty)				
613	-0.09664	0.2252937	-0.43	0.668	-0.53824	0.344965
625	-0.45186	0.2648998	-1.71	0.088	-0.97109	0.067375
637	-0.4374	0.2523944	-1.73	0.083	-0.93212	0.057318
649	-0.47454	0.2662005	-1.78	0.075	-0.99633	0.047238
661	-0.73022	0.2753831	-2.65	0.008	-1.27	-0.19044
673	-0.42009	0.2916443	-1.44	0.15	-0.99175	0.151563
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16424 16424 *					

Linear regression, absorbing indicators	Number of obs	=	114,361
	F(12,16481)	=	1,061
	Prob > F	=	0.000
	R-squared	=	0.8522
	Adj R-squared	=	0.8273
	Root MSE	=	8.4214

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
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bill_mo						
614	-6.0077	0.1015604	-59.15	0	-6.20677	-5.80863
626	-8.25352	0.1270804	-64.95	0	-8.50261	-8.00443
638	0.789432	0.1232145	6.41	0	0.547918	1.030946
650	-2.24152	0.1246372	-17.98	0	-2.48583	-1.99722
662	-4.11695	0.1298905	-31.7	0	-4.37155	-3.86235
674	-9.35032	0.1428154	-65.47	0	-9.63025	-9.07038
bill_mo#c.treatment						
602	0	(empty)				
614	-0.3753	0.1620422	-2.32	0.021	-0.69292	-0.05768
626	-0.50512	0.2036379	-2.48	0.013	-0.90427	-0.10597
638	-0.57928	0.1945611	-2.98	0.003	-0.96064	-0.19792
650	-0.35184	0.1996665	-1.76	0.078	-0.7432	0.039533
662	-0.5876	0.2082731	-2.82	0.005	-0.99584	-0.17936
674	-0.45678	0.2255886	-2.02	0.043	-0.89895	-0.0146
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoreis - Redundant					
account_id	0 16482 16482 *					

Linear regression, absorbing indicators	Number of obs	=	112,848
	F(13,16486)	=	429
	Prob > F	=	0.000
	R-squared	=	0.859
	Adj R-squared	=	0.8349
	Root MSE	=	6.759

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
615	0.005096	0.0762941	0.0762941	0.947	-0.14445	0.154641
627	-1.30013	0.0871635	0.0871635	0	-1.47098	-1.12928
639	-0.2093	0.1032496	0.1032496	0.043	-0.41168	-0.00692
651	-0.65407	0.1049121	0.1049121	0	-0.85971	-0.44843
663	-3.40513	0.1082168	0.1082168	0	-3.61725	-3.19302
675	-5.24352	0.1225911	0.1225911	0	-5.48381	-5.00323
bill_mo#c.treatment						
603	0.199716	0.1993949	0.1993949	0.317	-0.19112	0.590551

615	-0.12399	0.1561314	0.1561314	0.427	-0.43003	0.182041
627	-0.39102	0.171113	0.171113	0.022	-0.72642	-0.05562
639	-0.29737	0.1918483	0.1918483	0.121	-0.67341	0.078673
651	-0.32395	0.1951201	0.1951201	0.097	-0.7064	0.05851
663	-0.34018	0.2020984	0.2020984	0.092	-0.73631	0.055959
675	-0.19926	0.2175189	0.2175189	0.36	-0.62562	0.227097
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						
account_id						
0 16487 16487 *						

Linear regression, absorbing indicators	Number of obs	=	115,096
	F(12,16473)	=	817.13
	Prob > F	=	0.000
	R-squared	=	0.8715
	Adj R-squared	=	0.85
	Root MSE	=	7.5136

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
604	3.107172	0.0870828	35.68	0	2.936481	3.277864
616	2.918893	0.1015901	28.73	0	2.719766	3.118021
628	-0.27696	0.1097307	-2.52	0.012	-0.49204	-0.06187
640	-3.99074	0.1157949	-34.46	0	-4.21771	-3.76377
652	-0.95188	0.1250152	-7.61	0	-1.19693	-0.70684
664	-1.22423	0.1329045	-9.21	0	-1.48474	-0.96372
bill_mo#c.treatment						
592	0	(empty)				
604	0.022509	0.136256	0.17	0.869	-0.24457	0.289586
616	-0.40123	0.1607922	-2.5	0.013	-0.7164	-0.08606
628	-0.3617	0.1729559	-2.09	0.037	-0.70072	-0.02269
640	-0.51346	0.1832129	-2.8	0.005	-0.87257	-0.15434
652	-0.41966	0.1987745	-2.11	0.035	-0.80928	-0.03004
664	-0.41526	0.2123746	-1.96	0.051	-0.83153	0.00102
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						

account_id	0 16474 16474 *
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Linear regression, absorbing indicators	Number of obs	=	114,041
	F(12,16428)	=	1,371.76
	Prob > F	=	0.000
	R-squared	=	0.8714
	Adj R-squared	=	0.8497
	Root MSE	=	8.8162

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
605	5.223034	0.0987306	52.9	0	5.029511	5.416556
617	2.626915	0.1176009	22.34	0	2.396404	2.857425
629	-3.34817	0.1289847	-25.96	0	-3.601	-3.09535
641	-6.43527	0.136447	-47.16	0	-6.70272	-6.16782
653	-3.00024	0.14956	-20.06	0	-3.2934	-2.70709
665	-1.77387	0.1588546	-11.17	0	-2.08525	-1.4625
bill_mo#c.treatment						
593	0	(empty)				
605	-0.00489	0.1607789	-0.03	0.976	-0.32004	0.310251
617	-0.22492	0.189107	-1.19	0.234	-0.59559	0.145746
629	-0.41389	0.2047637	-2.02	0.043	-0.81525	-0.01253
641	-0.56686	0.219627	-2.58	0.01	-0.99735	-0.13637
653	-0.56552	0.2404528	-2.35	0.019	-1.03684	-0.09421
665	-0.36427	0.2571127	-1.42	0.157	-0.86824	0.139695
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16429 16429 *					

Linear regression, absorbing indicators	Number of obs	=	113,193
	F(12,16428)	=	2,133.24
	Prob > F	=	0.000
	R-squared	=	0.8707
	Adj R-squared	=	0.8487

Root MSE = 9.239

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
606	8.425555	0.1068978	78.82	0	8.216024	8.635087
618	5.790821	0.1244045	46.55	0	5.546974	6.034667
630	2.54745	0.1373403	18.55	0	2.278248	2.816652
642	-5.42498	0.1407143	-38.55	0	-5.70079	-5.14916
654	-5.59975	0.1529954	-36.6	0	-5.89964	-5.29987
666	-0.17083	0.1674132	-1.02	0.308	-0.49898	0.157318
bill_mo#c.treatment						
594	0	(empty)				
606	-0.21216	0.1732428	-1.22	0.221	-0.55174	0.127412
618	-0.34662	0.2006946	-1.73	0.084	-0.74001	0.046759
630	-0.17028	0.2181037	-0.78	0.435	-0.59779	0.257223
642	-0.58923	0.2263936	-2.6	0.009	-1.03299	-0.14547
654	-0.48291	0.2450091	-1.97	0.049	-0.96315	-0.00266
666	-0.21137	0.2678416	-0.79	0.43	-0.73637	0.313628
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16393 16393 *					

Linear regression, absorbing indicators	Number of obs	=	113,684
	F(12,16481)	=	1,604.99
	Prob > F	=	0.000
	R-squared	=	0.8733
	Adj R-squared	=	0.852
	Root MSE	=	8.8565

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
607	5.502495	0.1058139	52	0	5.295088	5.709901
619	4.531968	0.1179148	38.43	0	4.300843	4.763094
631	-3.09173	0.1290881	-23.95	0	-3.34475	-2.8387
643	-6.28806	0.1371703	-45.84	0	-6.55693	-6.01919

655	-5.94933	0.1473243	-40.38	0	-6.2381	-5.66056
667	-3.18172	0.1583441	-20.09	0	-3.49209	-2.87135
bill_mo#c.treatment						
595	0	(empty)				
607	-0.07403	0.1711487	-0.43	0.665	-0.4095	0.261438
619	-0.13883	0.1906563	-0.73	0.467	-0.51254	0.234873
631	-0.32045	0.2037984	-1.57	0.116	-0.71991	0.07902
643	-0.61703	0.2183845	-2.83	0.005	-1.04509	-0.18897
655	-0.61007	0.2356834	-2.59	0.01	-1.07203	-0.1481
667	-0.30467	0.2528125	-1.21	0.228	-0.80021	0.190872
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						
account_id						
0 16419 16419 *						

Linear regression, absorbing indicators	Number of obs	=	114,655
	F(12,16470)	=	952.41
	Prob > F	=	0.000
	R-squared	=	0.8763
	Adj R-squared	=	0.8555
	Root MSE	=	7.5761

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]		
bill_mo							
608	4.762761	0.089821	53.03	0	4.586702	4.93882	
620	-0.62552	0.0990191	-6.32	0	-0.81961	-0.43143	
632	-2.61214	0.1090833	-23.95	0	-2.82595	-2.39832	
644	-1.73559	0.1190815	-14.57	0	-1.96901	-1.50218	
656	-1.067	0.1281738	-8.32	0	-1.31824	-0.81577	
668	-3.85347	0.1317251	-29.25	0	-4.11167	-3.59528	
bill_mo#c.treatment							
596	0	(empty)					
608	-0.16653	0.1438872	-1.16	0.247	-0.44856	0.115506	
620	-0.24038	0.155779	-1.54	0.123	-0.54572	0.064968	
632	-0.30068	0.173261	-1.74	0.083	-0.64029	0.038934	
644	-0.34837	0.1909781	-1.82	0.068	-0.72271	0.02597	
656	-0.56721	0.2053654	-2.76	0.006	-0.96975	-0.16467	

668	-0.42438	0.2114893	-2.01	0.045	-0.83893	-0.00984
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16471 16471 *					

Linear regression, absorbing indicators	Number of obs	=	114,847
	F(12,16484)	=	285.82
	Prob > F	=	0.000
	R-squared	=	0.8632
	Adj R-squared	=	0.8402
	Root MSE	=	6.5302

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
609	-0.63106	0.0759421	-8.31	0	-0.77991	-0.4822
621	-1.74888	0.0856466	-20.42	0	-1.91675	-1.581
633	-1.5269	0.0999012	-15.28	0	-1.72272	-1.33108
645	-1.87821	0.0987089	-19.03	0	-2.07169	-1.68473
657	-2.68374	0.1056301	-25.41	0	-2.89079	-2.4767
669	-4.61121	0.1112393	-41.45	0	-4.82925	-4.39317
bill_mo#c.treatment						
597	0	(empty)				
609	-0.23199	0.1215224	-1.91	0.056	-0.47019	0.006206
621	-0.2842	0.1346762	-2.11	0.035	-0.54818	-0.02022
633	-0.4	0.1570315	-2.55	0.011	-0.7078	-0.09221
645	-0.35744	0.1595279	-2.24	0.025	-0.67013	-0.04475
657	-0.39146	0.1687047	-2.32	0.02	-0.72214	-0.06078
669	-0.47577	0.1776962	-2.68	0.007	-0.82408	-0.12747
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16485 16485 *					

Linear regression, absorbing indicators	Number of obs	=	114,516
	F(12,16477)	=	802.28
	Prob > F	=	0.000
	R-squared	=	0.8555

Adj R-squared	=	0.8312
Root MSE	=	8.4567

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
610	2.559972	0.0928774	27.56	0	2.377923	2.742022
622	-1.27114	0.1006534	-12.63	0	-1.46843	-1.07385
634	1.585976	0.1423356	11.14	0	1.306983	1.864969
646	1.284492	0.1203278	10.67	0	1.048637	1.520348
658	1.379306	0.1316636	10.48	0	1.121231	1.637381
670	-5.28117	0.1288684	-40.98	0	-5.53377	-5.02858
bill_mo#c.treatment						
598	0	(empty)				
610	-0.17511	0.1462514	-1.2	0.231	-0.46178	0.111555
622	-0.29705	0.1596651	-1.86	0.063	-0.61001	0.015912
634	-0.89522	0.2197912	-4.07	0	-1.32604	-0.46441
646	-0.37275	0.1938571	-1.92	0.055	-0.75273	0.007232
658	-0.50036	0.2104477	-2.38	0.017	-0.91286	-0.08786
670	-0.56275	0.2053127	-2.74	0.006	-0.96519	-0.16032
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 16478 16478 *					

Linear regression, absorbing indicators	Number of obs	=	112,762
	F(12,16440)	=	1,435.59
	Prob > F	=	0.000
	R-squared	=	0.8638
	Adj R-squared	=	0.8406
	Root MSE	=	10.4207

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
611	2.50841	0.1270906	19.74	0	2.259299	2.757521
623	-10.6566	0.1517016	-70.25	0	-10.9539	-10.3592
635	-11.3138	0.162234	-69.74	0	-11.6317	-10.9958

647	-5.43267	0.157612	-34.47	0	-5.7416	-5.12373
659	-8.52598	0.1692622	-50.37	0	-8.85775	-8.19421
671	-16.0944	0.193603	-83.13	0	-16.4739	-15.7149
bill_mo#c.treatment						
599	0	(empty)				
611	-0.11465	0.2038073	-0.56	0.574	-0.51414	0.284832
623	-0.40415	0.2420264	-1.67	0.095	-0.87855	0.07025
635	-0.51947	0.2584384	-2.01	0.044	-1.02604	-0.0129
647	-0.33641	0.2528692	-1.33	0.183	-0.83206	0.159245
659	-0.61806	0.2705374	-2.28	0.022	-1.14834	-0.08778
671	-0.48287	0.3089846	-1.56	0.118	-1.08852	0.122771
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						
account_id						
0 16441 16441 *						

* = fixed effect nested within cluster; treated as redundant for DoF computation

Table 5-3: Regression Coefficients for Cohort 2

Linear regression, absorbing indicators	Number of obs	=	3,204,135
	F(8,668257)	=	29,219.71
	Prob > F	=	0.000
	R-squared	=	0.8918
	Adj R-squared	=	0.8633
	Root MSE	=	9.7975

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
636	1.106336	0.0416488	26.56	0	1.024706	1.187967
648	8.566422	0.077632	110.35	0	8.414266	8.718578
660	4.187392	0.0771984	54.24	0	4.036085	4.338698
672	2.356293	0.0818163	28.8	0	2.195936	2.516651
bill_mo#c.treatment						
624	0	(empty)				

636	0.434278	0.042595	10.2	0	0.350793	0.517763
648	-0.03733	0.0787153	-0.47	0.635	-0.19161	0.116948
660	-0.00669	0.0783585	-0.09	0.932	-0.16027	0.146886
672	-0.1407	0.0832964	-1.69	0.091	-0.30396	0.022559
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						
account_id	0 668258 668258 *					

Linear regression, absorbing indicators	Number of obs	=	3,220,240
	F(8,669625)	=	31,906.93
	Prob > F	=	0.000
	R-squared	=	0.8864
	Adj R-squared	=	0.8566
	Root MSE	=	9.8561

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
637	5.045016	0.0423091	119.24	0	4.962092	5.12794
649	6.976981	0.0687285	101.52	0	6.842275	7.111686
661	9.403895	0.0854653	110.03	0	9.236386	9.571404
673	3.741878	0.0797557	46.92	0	3.58556	3.898197
bill_mo#c.treatment						
625	0	(empty)				
637	0.419915	0.0430934	9.74	0	0.335454	0.504377
649	-0.0598	0.0694393	-0.86	0.389	-0.1959	0.076299
661	-0.31043	0.08682	-3.58	0	-0.48059	-0.14026
673	-0.42461	0.0811853	-5.23	0	-0.58373	-0.26549
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Categoriis - Redundant						
account_id	0 669626 669626 *					

Linear regression, absorbing indicators	Number of obs	=	3,870,424
	F(8,675290)	=	29,132.19
	Prob > F	=	0.000

R-squared = 0.851
Adj R-squared = 0.8195
Root MSE = 8.5564

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
626	-2.91502	0.0122783	-237.41	0	-2.93908	-2.89095
638	5.931207	0.0406641	145.86	0	5.851506	6.010907
650	4.508144	0.0597462	75.45	0	4.391043	4.625245
662	2.374456	0.0607464	39.09	0	2.255396	2.493517
674	-2.87046	0.0587792	-48.83	0	-2.98567	-2.75526
bill_mo#c.treatment						
614	0	(empty)				
626	-0.36301	0.0121177	-29.96	0	-0.38676	-0.33926
638	-0.06013	0.0415849	-1.45	0.148	-0.14163	0.021377
650	-0.27534	0.0603702	-4.56	0	-0.39367	-0.15702
662	-0.33269	0.0614561	-5.41	0	-0.45314	-0.21224
674	-0.33577	0.0596435	-5.63	0	-0.45267	-0.21887
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 675291 675291 *					

Linear regression, absorbing indicators Number of obs = 3,805,067
F(10,675537) = 13,162.87
Prob > F = 0.000
R-squared = 0.8618
Adj R-squared = 0.832
Root MSE = 6.5743

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
627	-1.43845	0.01015	-141.72	0	-1.45834	-1.41855
639	0.004987	0.0300843	0.17	0.868	-0.05398	0.063952
651	-0.20772	0.0438757	-4.73	0	-0.29371	-0.12172
663	-2.64688	0.0469542	-56.37	0	-2.73891	-2.55485
675	-2.87264	0.055604	-51.66	0	-2.98163	-2.76366

bill_mo#c.treatment						
615	0	(empty)				
627	2.776811	4.238355	0.66	0.512	-5.53023	11.08385
639	0.246708	0.0301983	8.17	0	0.18752	0.305896
651	-0.26139	0.0441507	-5.92	0	-0.34793	-0.17486
663	-0.15482	0.047459	-3.26	0.001	-0.24783	-0.0618
675	-0.70838	0.0565878	-12.52	0	-0.81929	-0.59747
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 675538 675538 *					

Linear regression, absorbing indicators	Number of obs	=	3,257,352
	F(8,674457)	=	16,757.99
	Prob > F	=	0.000
	R-squared	=	0.8788
	Adj R-squared	=	0.8472
	Root MSE	=	7.1362

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
628	-2.68838	0.0120645	-222.83	0	-2.71202	-2.66473
640	-4.92139	0.0328586	-149.78	0	-4.9858	-4.85699
652	-3.02236	0.0460944	-65.57	0	-3.11271	-2.93202
664	-2.86549	0.0544279	-52.65	0	-2.97216	-2.75881
bill_mo#c.treatment						
616	0	(empty)				
628	0.199248	0.0458611	4.34	0	0.109362	0.289135
640	-0.2318	0.0326855	-7.09	0	-0.29586	-0.16773
652	-0.19431	0.0461531	-4.21	0	-0.28477	-0.10385
664	0.004631	0.0549216	0.08	0.933	-0.10301	0.112275
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					

account_id	0 674458 674458 *
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Linear regression, absorbing indicators	Number of obs	=	3,236,291
	F(8,671524)	=	36,188.87
	Prob > F	=	0.000
	R-squared	=	0.8915
	Adj R-squared	=	0.8631
	Root MSE	=	8.0133

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
629	-4.65996	0.0135649	-343.53	0	-4.68654	-4.63337
641	-7.37438	0.0357229	-206.43	0	-7.44439	-7.30436
653	-4.29665	0.0538897	-79.73	0	-4.40227	-4.19103
665	-1.95642	0.0638041	-30.66	0	-2.08147	-1.83136
bill_mo#c.treatment						
617	0	(empty)				
629	0.49687	0.0311495	15.95	0	0.435818	0.557922
641	0.062878	0.0353753	1.78	0.075	-0.00646	0.132212
653	-0.19421	0.0540644	-3.59	0	-0.30018	-0.08825
665	-0.30523	0.0646136	-4.72	0	-0.43187	-0.17859
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 671525 671525 *					

Linear regression, absorbing indicators	Number of obs	=	3,217,811
	F(8,66958)	=	67,049.05
	Prob > F	=	0.000
	R-squared	=	0.892
	Adj R-squared	=	0.8636
	Root MSE	=	8.3993

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
630	-1.62973	0.0146798	-111.02	0	-1.6585	-1.60095
642	-8.28101	0.0379142	-218.41	0	-8.35532	-8.2067
654	-9.51424	0.0576636	-165	0	-9.62725	-9.40122
666	-3.77412	0.0673476	-56.04	0	-3.90612	-3.64212
bill_mo#c.treatment						
618	0	(empty)				
630	-0.67293	0.0257437	-26.14	0	-0.72338	-0.62247
642	-0.40727	0.0375695	-10.84	0	-0.4809	-0.33363
654	-0.28212	0.0578287	-4.88	0	-0.39546	-0.16877
666	-0.62272	0.068193	-9.13	0	-0.75637	-0.48906
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 669583 669583 *					

Linear regression, absorbing indicators	Number of obs	=	3,239,201
	F(8,671419)	=	4,9451.07
	Prob > F	=	0.000
	R-squared	=	0.8937
	Adj R-squared	=	0.8659
	Root MSE	=	7.9642

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
631	-4.90882	0.0144521	-339.66	0	-4.93714	-4.88049
643	-7.97459	0.0350428	-227.57	0	-8.04327	-7.90591
655	-7.76016	0.0548365	-141.51	0	-7.86763	-7.65268
667	-4.87543	0.0638109	-76.4	0	-5.0005	-4.75036
bill_mo#c.treatment						
619	0	(empty)				
631	-1.42079	0.0238641	-59.54	0	-1.46756	-1.37401
643	-0.82234	0.0345126	-23.83	0	-0.88999	-0.7547
655	-1.08716	0.0549586	-19.78	0	-1.19487	-0.97944

667	-0.72034	0.0645384	-11.16	0	-0.84684	-0.59385
Absorbed degrees of freedom:						
Absorbed FE						
Num. Coefs. = Cateгореis - Redundant						
account_id						
0 671420 671420 *						

Linear regression, absorbing indicators	Number of obs	=	3,268,187
	F(8,674203)	=	5,060.56
	Prob > F	=	0.000
	R-squared	=	0.8948
	Adj R-squared	=	0.8675
	Root MSE	=	6.7003

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
632	-1.58006	0.014782	-106.89	0	-1.60904	-1.55109
644	-0.83604	0.0329986	-25.34	0	-0.90072	-0.77137
656	-0.73682	0.0472353	-15.6	0	-0.8294	-0.64424
668	-1.6895	0.0535601	-31.54	0	-1.79447	-1.58452
bill_mo#c.treatment						
620	0	(empty)				
632	0.220677	0.0177559	12.43	0	0.185876	0.255478
644	-0.28234	0.033007	-8.55	0	-0.34703	-0.21765
656	-0.03579	0.0475946	-0.75	0.452	-0.12908	0.057492
668	-0.53646	0.0542967	-9.88	0	-0.64288	-0.43004
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoreis - Redundant					
account_id	0 674204 674204 *					

Linear regression, absorbing indicators	Number of obs	=	3,282,149
	F(8,675407)	=	6,559.55
	Prob > F	=	0.000
	R-squared	=	0.8807
	Adj R-squared	=	0.8498
	Root MSE	=	6.023

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
633	-0.14641	0.0152951	-9.57	0	-0.17638	-0.11643
645	-0.43654	0.032699	-13.35	0	-0.50063	-0.37245
657	-1.12804	0.0437282	-25.8	0	-1.21375	-1.04233
669	-2.40365	0.0484878	-49.57	0	-2.49869	-2.30862
bill_mo#c.treatment						
621	0	(empty)				
633	0.099826	0.0172564	5.78	0	0.066004	0.133648
645	-0.06911	0.032864	-2.1	0.035	-0.13352	-0.0047
657	-0.07578	0.044167	-1.72	0.086	-0.16235	0.010784
669	-0.16648	0.0492343	-3.38	0.001	-0.26298	-0.06999
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 675408 675408 *					

Linear regression, absorbing indicators	Number of obs	=	3,277,779
	F(8,675407)	=	29,988.4
	Prob > F	=	0.000
	R-squared	=	0.8775
	Adj R-squared	=	0.8457
	Root MSE	=	7.9296

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
634	0.809735	0.0343125	23.6	0	0.742484	0.876987
646	2.691673	0.0469082	57.38	0	2.599734	2.783611
658	2.463007	0.059951	41.08	0	2.345505	2.580509
670	-3.44011	0.0622825	-55.23	0	-3.56218	-3.31804
bill_mo#c.treatment						
622	0	(empty)				
634	0.559537	0.0351962	15.9	0	0.490554	0.628521
646	-0.35304	0.0472969	-7.46	0	-0.44574	-0.26034
658	-0.18042	0.0606086	-2.98	0.003	-0.29921	-0.06163

670	-0.45305	0.0633929	-7.15	0	-0.5773	-0.3288
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 674835 674835 *					

Linear regression, absorbing indicators	Number of obs	=	3,254,277
	F(8,675407)	=	38,694.25
	Prob > F	=	0.000
	R-squared	=	0.8839
	Adj R-squared	=	0.8537
	Root MSE	=	9.0371

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
635	-0.59765	0.0367039	-16.28	0	-0.66959	-0.52572
647	4.752936	0.0603463	78.76	0	4.634659	4.871213
659	2.177178	0.0696629	31.25	0	2.040641	2.313715
671	-4.75749	0.0717224	-66.33	0	-4.89806	-4.61691
bill_mo#c.treatment						
623	0	(empty)				
635	0.385331	0.0375559	10.26	0	0.311723	0.458939
647	-0.07916	0.0611322	-1.29	0.195	-0.19898	0.040654
659	-0.025	0.0705589	-0.35	0.723	-0.16329	0.113294
671	-0.01412	0.0729895	-0.19	0.847	-0.15718	0.128938
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 672697 672697 *					

* = fixed effect nested within cluster; treated as redundant for DoF computation

Table 5-4: Regression Coefficients for Cohort 3

Linear regression, absorbing indicators	Number of obs	=	1,439,485
	F(5,53112)	=	11,656.12
	Prob > F	=	0.000
	R-squared	=	0.924
	Adj R-squared	=	0.8795
	Root MSE	=	9.4981

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
660	-4.03741	0.0389571	-103.64	0	-4.11376	-3.96106
672	-5.25372	0.0678362	-77.45	0	-5.38668	-5.12076
bill_mo#c.treatment						
648	-0.69739	0.2120417	-3.29	0.001	-1.11299	-0.2818
660	0.461275	0.0389764	11.83	0	0.384882	0.537667
672	-0.39896	0.0677486	-5.89	0	-0.53175	-0.26618
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 531124 531124 *					

Linear regression, absorbing indicators	Number of obs	=	1,774,481
	F(7,534971)	=	13,884.24
	Prob > F	=	0.000
	R-squared	=	0.9089
	Adj R-squared	=	0.8696
	Root MSE	=	9.7682

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
649	1.669091	0.021032	79.36	0	1.627869	1.710313
661	4.830485	0.0426433	113.28	0	4.746906	4.914065
673	-0.45837	0.0672793	-6.81	0	-0.59023	-0.3265
bill_mo#c.treatment						
637	1.701491	3.987865	0.43	0.67	-6.1146	9.51758

649	1.42265	0.1161981	12.24	0	1.194905	1.650395
661	-0.00801	0.0420746	-0.19	0.849	-0.09048	0.074453
673	-0.43122	0.066549	-6.48	0	-0.56165	-0.30078
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 534972 534972 *					

Linear regression, absorbing indicators	Number of obs	=	1,833,529
	F(5,545614)	=	22,103.52
	Prob > F	=	0.000
	R-squared	=	0.8857
	Adj R-squared	=	0.8373
	Root MSE	=	8.4536

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
650	-1.31962	0.0185518	-71.13	0	-1.35598	-1.28326
662	-2.78784	0.0349429	-79.78	0	-2.85632	-2.71935
674	-7.36322	0.0611562	-120.4	0	-7.48309	-7.24336
bill_mo#c.treatment						
638	-0.61313	4.152246	-0.15	0.883	-8.7514	7.525141
650	0.653776	0.0848452	7.71	0	0.487482	0.82007
662	-0.08922	0.0325187	-2.74	0.006	-0.15296	-0.02549
674	-0.54891	0.0599729	-9.15	0	-0.66645	-0.43136
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 545615 545615 *					

Linear regression, absorbing indicators	Number of obs	=	1,800,949
	F(7,538452)	=	5,321.92

Prob > F = 0.000
R-squared = 0.8875
Adj R-squared = 0.8395
Root MSE = 6.2894

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
651	-0.25313	0.013964	-18.13	0	-0.2805	-0.22576
663	-1.76698	0.0267369	-66.09	0	-1.81938	-1.71457
675	-1.84397	0.0466438	-39.53	0	-1.93539	-1.75255
bill_mo#c.treatment						
639	-1.66814	0.9044456	-1.84	0.065	-3.44082	0.104547
651	0.711575	0.0510409	13.94	0	0.611536	0.811613
663	-0.43293	0.0257363	-16.82	0	-0.48337	-0.38249
675	-0.64927	0.046185	-14.06	0	-0.73979	-0.55875
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 538453 538453 *					

Linear regression, absorbing indicators

Number of obs = 1,307,974
F(5,478082) = 4,802.49
Prob > F = 0.000
R-squared = 0.9104
Adj R-squared = 0.8395
Root MSE = 6.6252

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
652	1.860349	0.015022	123.84	0	1.830906	1.889792
664	3.401588	0.0393103	86.53	0	3.324541	3.478635
bill_mo#c.treatment						
640	-1.76479	1.792113	-0.98	0.325	-5.27728	1.747694

652	0.993712	0.0522762	19.01	0	0.891252	1.096172
664	-1.00988	0.0399177	-25.3	0	-1.08812	-0.93164
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 478083 478083 *					

Linear regression, absorbing indicators	Number of obs	=	1,329,518
	F(5,478082)	=	20,220.15
	Prob > F	=	0.000
	R-squared	=	0.9195
	Adj R-squared	=	0.873
	Root MSE	=	7.6055

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
653	3.329057	0.0164823	201.98	0	3.296752	3.361362
665	6.864952	0.0470593	145.88	0	6.772717	6.957187
bill_mo#c.treatment						
641	2.138975	0.9856121	2.17	0.03	0.207206	4.070744
653	1.098316	0.0513313	21.4	0	0.997708	1.198924
665	-0.81431	0.0480553	-16.95	0	-0.90849	-0.72012
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 486530 486530 *					

Linear regression, absorbing indicators	Number of obs	=	1,354,004
	F(5,496811)	=	32,340.93
	Prob > F	=	0.000
	R-squared	=	0.9188

Adj R-squared = 0.8717
Root MSE = 7.8862

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
654	-1.1822	0.0165481	-71.44	0	-1.21463	-1.14976
666	6.131956	0.0501981	122.16	0	6.03357	6.230343
bill_mo#c.treatment						
642	5.171823	0.6874035	7.52	0	3.824533	6.519112
654	1.521308	0.0465133	32.71	0	1.430143	1.612472
666	-1.05961	0.0514725	-20.59	0	-1.16049	-0.95872
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 496812 496812 *					

Linear regression, absorbing indicators

Number of obs = 1,392,231

F(5,511104) = 12,107.46

Prob > F = 0.000

R-squared = 0.9219

Adj R-squared = 0.8765

Root MSE = 7.3802

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
655	0.388286	0.0156132	24.87	0	0.357685	0.418887
667	4.58562	0.0456193	100.52	0	4.496208	4.675033
bill_mo#c.treatment						
643	6.654443	3.518523	1.89	0.059	-0.24175	13.55064
655	0.730407	0.0394433	18.52	0	0.653099	0.807715
667	-0.93664	0.0467282	-20.04	0	-1.02823	-0.84505
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 511105 511105 *					

Linear regression, absorbing indicators	Number of obs	=	1,422,281
	F(5,522201)	=	1,371.84
	Prob > F	=	0.000
	R-squared	=	0.9189
	Adj R-squared	=	0.8781
	Root MSE	=	6.4189

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
656	0.599252	0.01383	43.33	0	0.572145	0.626358
668	1.70442	0.0401372	42.46	0	1.625752	1.783088
bill_mo#c.treatment						
644	7.184001	4.380494	1.64	0.101	-1.40163	15.76963
656	0.573262	0.0324399	17.67	0	0.509681	0.636843
668	-1.87292	0.0410293	-45.65	0	-1.95334	-1.7925
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Categoriis - Redundant					
account_id	0 522202 522202 *					

Linear regression, absorbing indicators	Number of obs	=	1,453,617
	F(5,534416)	=	3,143.37
	Prob > F	=	0.000
	R-squared	=	0.9077
	Adj R-squared	=	0.854
	Root MSE	=	5.7542

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
657	-0.36466	0.0122046	-29.88	0	-0.38858	-0.34074

669	-0.47001	0.0338315	-13.89	0	-0.53631	-0.4037
bill_mo#c.treatment						
645	3.45322	3.44997	1	0.317	-3.30861	10.21505
657	0.343049	0.0283241	12.11	0	0.287534	0.398563
669	-1.11843	0.0346317	-32.29	0	-1.18631	-1.05055
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 534417 534417 *					

Linear regression, absorbing indicators	Number of obs	=	1,474,444
	F(5,543345)	=	28,375.83
	Prob > F	=	0.000
	R-squared	=	0.9006
	Adj R-squared	=	0.8426
	Root MSE	=	8.0966

dailykwh	Coef.	Std. Err.	t	P> t 	[95% Conf. Interval]	
bill_mo						
658	0.168291	0.016494	10.2	0	0.135963	0.200618
670	-4.78256	0.0444314	-107.64	0	-4.86964	-4.69548
bill_mo#c.treatment						
646	-1.60989	1.272622	-1.27	0.206	-4.10419	0.884409
658	0.314811	0.0382347	8.23	0	0.239872	0.389749
670	-0.90031	0.045925	-19.6	0	-0.99032	-0.8103
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 543346 543346 *					

Linear regression, absorbing indicators	Number of obs	=	1,467,834
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F(5,541061)	=	35,894.03
Prob > F	=	0.000
R-squared	=	0.903
Adj R-squared	=	0.8464
Root MSE	=	9.3949

dailykwh	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
bill_mo						
659	-1.8704	0.021088	-88.69	0	-1.91173	-1.82907
671	-8.01928	0.0541917	-147.98	0	-8.12549	-7.91306
bill_mo#c.treatment						
647	-4.94063	1.18871	-4.16	0	-7.27047	-2.6108
659	-0.02383	0.031911	-0.75	0.455	-0.08638	0.038714
671	-0.73122	0.0554026	-13.2	0	-0.8398	-0.62263
Absorbed degrees of freedom:						
Absorbed FE	Num. Coefs. = Cateгореis - Redundant					
account_id	0 541062 541062 *					

* = fixed effect nested within cluster; treated as redundant for DoF computation

Appendix F Awareness and Engagement Index

The increased engagement and awareness generated by the MyHER program can be difficult to measure. Nexant designed a survey approach that measures different aspects of the MyHER effect, but no one survey question can fully capture the numerous, subtle effects of MyHER that ultimately resulted in the observed energy impacts. Instead, one might expect the overall pattern of survey responses to signal a difference in behavior and attitudes between the MyHER treatment and control group.

Nexant developed a framework for measuring this pattern of MyHER influence by applying straightforward statistical concepts to develop a holistic look at the program's influence on customer behavior. While a single survey question may not result in statistically-significant differences between the treatment and control group, if the treatment group responds more favorably than the control group to a set of survey questions, then we can estimate the probability that the collection of responses fits of a hypothesis of MyHER influence.

Consider a series of coin flips. What is the probability of obtaining 24 heads in 47 coin flips if there is a 50/50 chance of obtaining a heads or tails on any one coin flip? This same principle can be applied to the survey: what is the probability that the treatment group gives a more favorable response to 24 out of 47 survey questions if MyHER has no influence on customer awareness and attitudes about energy efficiency?

Nexant assigned each survey question a category. Table shows the categories, the count of questions in each category for which the treatment group provided a more favorable response than the control group, and the number of questions in each category. A response is considered "favorable" if the treatment group gave a response that is consistent with the program objectives of MyHER.

Table F-1: Classification of Survey Responses and Treatment Group "Success Rate"

Question Category	Count of Questions where T>C	Number of Questions in Topic Area	Portion of Questions where T>C
Duke Energy's Public Stance on Energy Efficiency	3	3	100%
Customer Engagement with Duke Energy Website	3	6	50%
Customers' Reported Energy-saving Behaviors	2	7	29%
Customers' Past & Future Equipment Purchases	7	16	44%
Customer Motivation, Engagement & Awareness of Energy Efficiency	8	11	73%
Customer Satisfaction with Duke Energy	1	4	0%
Total	24	47	51%

If the MyHER program had no effect on participants' awareness, attitudes, and opinions, then we would expect the control group to score better than the treatment group on approximately half of the survey questions. The treatment group provided answers consistent with a MyHER treatment effect in approximately 51% of the survey questions. Using standard statistical techniques (specifically, the non-parametric sign test), Nexant calculated the probability of randomly obtaining this result is 11.5%. The statistical test shows that, overall, we cannot conclude (with a reasonable level of confidence) that the MyHER program has changed the attitudes, awareness, behaviors, and motivations that can lead to saving energy of the customers who receive the reports. However, these survey responses do indicate strengths in the areas of treatment customers' perception of Duke Energy's public stance on energy efficiency as well as their stated levels of motivation, engagement, and awareness of energy efficiency.

Appendix G MyHER Control Group Size Memorandum

September 4, 2015

To: Roshena Ham, Melinda Goins, Rose Stoeckle, Jean Williams; Duke Energy

From: Mike Sullivan, Jesse Smith, Tingting Xue; Nexant

CC: Jim Herndon, Rush Childs, Patrick Burns, Dulane Moran; Nexant

RE: Analysis of Control Group Requirements for DEC MyHER and DEP MyHER Programs

G.1 Introduction

Duke Energy requested that Nexant determine whether it is possible to reduce the control group size of its Duke Energy Carolinas (DEC) MyHER and Duke Energy Progress (DEP) MyHER programs while continuing to meet regulatory EM&V requirements and manage its own risk of under compensation for achieved energy savings. Nexant conducted the analysis of the control group sizes for both DEC and DEP MyHER programs. This memorandum provides detailed information about the analysis, findings, and Nexant's recommendations.

G.2 Background

The DEC and DEP MyHER programs consist of customers from both North Carolina and South Carolina. The programs' backgrounds, key concepts, considerations, and objectives for control group size analysis are the same as those for the DEO MyHER program, which were well-defined in Nexant's DEO MyHER Program Evaluation Report and Memorandum of Control Group Requirements for DEO MyHER.

G.3 Study Approach & Methodology

Nexant's control group analysis for DEP and DEC followed the same study approach used to determine an appropriate control group size for the DEO MyHER program. The simulation was based on DEC and DEP MyHER program tracking records and monthly billing records from Duke's data warehouse. According to Duke Energy's request, there is no need to estimate effects for North Carolina and South Carolina separately. Nevertheless, separate impact estimates for DEC and DEP are desired for the foreseeable future. Nexant also observed a consistent difference in mean energy consumption between the MyHER populations in DEC and DEP (DEP customers use more energy on average). This difference could complicate impact analyses if the two jurisdictions were aggregated. Nexant therefore conducted the analysis of control group size separately for the DEC and DEP MyHER programs. This memorandum describes Nexant's simulation process, its results, and recommendations for how the results may be used by Duke Energy to select its preferred control group size for DEC and DEP MyHER programs.

Because the control group size analysis was conducted in advance of the impact evaluation, there is some uncertainty in what the average savings per home will be for DEP and DEC.

G-1

Nexant's approach was to target an absolute margin of error equal to ± 15 kWh per home at the 90% confidence level. Therefore, the relative precision will be a function of the estimated impact size. If the average savings per home turns out to be 150 kWh, the relative precision will be $\pm 10\%$. If the average impact is 250 kWh per home, the relative precision will equal $\pm 6\%$.

G.4 DEC MyHER Program

Unlike the DEP MyHER program, DEC MyHER had waves of homes assigned through the years of 2010 to 2015. Therefore, the simulations needed to consider the need to analyze these cohorts separately. We defined three distinct cohorts: 2010 customer group, 2012 & 2013 customer group, and 2014 & 2015 customer group, with a separate analysis for each. The overall absolute margin of error for the DEC MyHER was then combined mathematically. The number of active accounts as of June 2015 in the treatment and control groups of DEC MyHER is listed in Table 5-5.

Table 5-5: DEC MyHER Program Control and Treatment Accounts Summary

Duke Energy Carolinas (DEC)		
Year Added	Treatment Accounts	Control Accounts
2010	6,485	21,195
2012	579,796	126,934
2013	66,867	1,574
2014	381,240	47,440
2015	50,457	29,863
DEC Total	1,084,845	227,006

G.5 Simulation Process

The simulation process for the DEC MyHER was the same as DEP MyHER, but conducted separately for the three cohorts. For each control group size, the process was repeated 500 times. Since there were no North Carolina customers in the treatment and control groups in the year of 2010, the 2010 cohort only includes customers from South Carolina. The 2012 & 2013 cohort and 2014 & 2015 cohort include both North Carolina and South Carolina customers.

G.6 Results and Recommendations

Table 5-6 presents the simulation results for the DEC MyHER program. Our recommended control group size for each cohort is shown in green: 10,000 for cohort 1; 35,000 for cohort 2; and 35,000 for cohort 3. This will result in a control group size of 80,000 in total for the DEC MyHER program. Each absolute margin of error (kWh) at 90% confidence level that listed in Table 5-6 corresponds to each individual control group size.

Table 5-6: Simulation Results for DEC MyHER "False Experiment"

Cohort Number	Cohort Description	Active Accounts	Control Group Size	Treatment Group Size	Absolute Margin of Error (kWh) at 90% Confidence
1	2010 South Carolina Customers	27,680	10,000	17,680	+/- 46.3
			15,000	12,680	+/- 45.9
2	2012 & 2013 Carolina Customers	775,171	35,000	740,171	+/- 20.3
			40,000	735,171	+/- 19.2
			50,000	725,171	+/- 17.7
			75,000	700,171	+/- 15.0
3	2014 & 2015 Carolina Customers	509,000	35,000	474,000	+/- 20.6
			40,000	469,000	+/- 19.6
			60,000	449,000	+/- 17.2

The combined margin of error across the three DEC cohorts will be narrower than any of the groups individually. The calculation of the combined error bound is shown below.

Step 1: Calculate Error Bound for each cohort based on recommended control group size:

$$\text{Error Bound of Cohort} = n * AE$$

Where:

n = Treatment Group Size = Number of Active Accounts – Recommended Control Group Size

AE = Absolute Margin of Error at 90% Confidence Level (kWh) of each cohort

Error Bound of Cohort 1 = 17,680 * 46.3157 = 818,862

Error Bound of Cohort 2 = 740,171 * 20.3272 = 15,045,610

Error Bound of Cohort 3 = 474,000 * 20.5953 = 9,762,171

Step 2: Calculate Combined Error Bound:

$$\text{Combined Error Bound} = \pm \frac{\sqrt{rb1^2 + rb2^2 + rb3^2}}{N1 + N2 + N3}$$

Where:

rb1, rb2, & rb3 = Error Bounds of Cohort 1, 2 & 3, respectively

N1, N2, & N3 = Remaining Treatment Group Size for Cohort 1, 2 & 3, respectively

$$\text{Combined Error Bound} = \pm \frac{\sqrt{818,862^2 + 15,045,610^2 + 9,762,171^2}}{17,680 + 740,171 + 474,000}$$

Combined Error Bound = ±14.6 kWh

Nexant recommends Duke release approximately 147,000 homes from control to treatment in DEC territory. Table 5-7 shows the number of homes to release from each group.

Table 5-7: Number of homes to release from each cohort for DEC MyHER

Cohort	Cohort Description	Current Control Size	Target Control Size	Number of Accounts to Release
1	2010 South Carolina Customers	21,195	10,000	11,195
2	2012 & 2013 Carolina Customers	128,508	35,000	93,508
3	2014 & 2015 Carolina Customers	77,303	35,000	42,303
DEC Total		227,006	80,000	147,006

G.7 Next Steps

We understand that Duke may wish to move quickly and implement control group release in Ohio and the Carolinas during the October cycle of MyHER. As a result, Nexant has randomly selected control group accounts to release in each jurisdiction should Duke elect to follow the recommendations in this memo and the MyHER Ohio EM&V report. These files were uploaded to the project's secure file transfer protocol (sftp) site in a file named "Control Group Accounts to Release by Jurisdiction – Nexant Recommendations.xlsx". Each group of control group accounts was selected randomly and tested for equivalent usage patterns against the accounts that will remain in the control group. Since the remaining control group accounts will essentially be serving double-duty and providing baseline usage against which to measure impacts of both the original treatment group and this newly released treatment group, Nexant also validated that the pre-assignment usage of the new, smaller control groups show no statistically significant differences with the original treatment group to which they will be added.

Appendix H Review of Ex-ante Savings Estimates Memo

February 10, 2016

To: Benjamin Lowe, Melinda Goins, Rose Stoeckle, Jean Williams; Duke Energy
From: Rush Childs, Mike Sullivan; Nexant
CC: Jim Herndon, Patrick Burns, Dulane Moran; Nexant
RE: Review of Ex-Ante Savings Assumptions – DEC & DEP

H.1 Background

Duke Energy has retained Nexant to perform an impact and process evaluation of its MyHER program in Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) jurisdictions. The evaluation period of performance will be May 2015 through April 2016 for both jurisdictions. This memorandum is pursuant to Milestone D of the Statement of Work for the evaluation – “Review of Ex Ante Estimated/Deemed Savings Assumptions”. The MyHER program is an energy awareness and conservation initiative that provides participating homes with reports eight times per year that compare their energy consumption to comparable homes and provide recommendations for saving energy. The review presented in this memo is based on evaluations conducted in other jurisdictions as well as files describing energy consumption for treatment and control groups provided to Nexant by Duke for a 2015 sample size simulation analysis. A brief description of these files is included below.

- 1) *MyHER deemed savings report DEI DEO DEK DEC 02 01 2015.xlsx*. The savings assumptions shown in Table 5-8 were taken from this spreadsheet.

Table 5-8: DEC and DEP MyHER Ex-Ante Savings Assumptions

State	Measure Name	Annual kWh Gross w/o losses	Saved Summer Coincident kW w/o losses	Annual non-coincident kW w/o losses	Measure Life	Free Rider %
SC	My Home Energy Report (EMV 11.1.13)	183.7	0.0389	0.0572	1	0.00%
NC	My Home Energy Report (EMV 11.1.13)	183.7	0.0389	0.0572	1	0.00%

- 2) *Program Year 2 (2012-2013) EM&V Report for the Residential Energy Efficiency Benchmarking Program*. This previous evaluation report was submitted in 2014 and examined impacts of an HER offering from a different vendor on approximately 60,000 households.
- 3) *Process and Impact Evaluation of the My Home Energy Report (MyHER) Program in the Carolina System*. This previous evaluation was submitted in February 2014 and is the basis of the 183.7 kWh per home savings estimate in Table 5-8.

- 4) *DEC and DEP Sample Composition and Size Analysis - Data Request Response.* On June 5, 2015 Nexant requested a participant list and billing history of each account in the MyHER control and treatment group in the Carolinas. The intent of this data request was to examine the relationship between control group size and the precision of MyHER impact estimates. Ultimately, Nexant recommended a reduction in the control group size for both jurisdictions and Duke implemented the control group release in October 2015. This data set provided useful information about the average electric consumption per home and early indication of the magnitude of savings.
- 5) *My Home Energy Report Program Evaluation.* This report was submitted in September 2015 and summarized Nexant's evaluation of MyHER in DEO service territory.

H.2 Benchmarking

The 184 kWh/year average impact per treatment customer claimed by Duke in the Carolinas is comparable to other deployments of home energy report programs across the United States. Table 5-9 shows energy savings estimates from 12 other HER deployments, including two in the Duke Energy system. Although this type of summary information can be deceptive because it does not account for differences in the types of homes targeted, duration of exposure, heating fuel saturations, or weather, it indicates that 184 kWh per home annually is a comfortably in the middle of the annual impact estimates observed in other jurisdictions.

Table 5-9: Annual Impact Estimates from HER Deployments

Utility	Implementation Period	# of Treatment Customers	Annual kWh per Treated Home
Pennsylvania Power & Light	June 2012-May 2013	93,924	388
AEP Ohio	2012	197,646	377
Puget Sound Energy	2013	40,000	325
Com-Ed	June 2010-May 2011	45,171	282
Indianapolis Power & Light Company	March 2012-February 2013	25,000	266
Duke Energy Ohio	March 2014-February 2015	299,000	256
Connexus Energy	March 2009-January 2010	40,000	229
Indiana Michigan Power	May 2012-December 2012	47,987	200
FirstEnergy Ohio	2013	73,000	175
Ameren Illinois	August 2010-November 2011	198,494	159
Duke Energy Indiana	August 2014-July 2015	~140,000	~150 ³
Pacific Gas & Electric	2014	1,017,692	104

³ The DEI MyHER impact estimate is still preliminary at the time this memo was drafted and may change based on the QA/QC process

Because of the differences in pre-treatment electric consumption across jurisdictions and HER deployments it is helpful to also consider impacts on a relative or percent reduction basis. Nexant examined the average billed consumption for members of the DEC and DEP MyHER control groups in 2013 and 2014 and found that DEP homes have higher average consumption than DEC homes. Figure 21 shows the average billed kWh by month for the two jurisdictions as well as the number of control group homes analyzed. The DEP average consumption is higher in all 24 months.

Figure 21: Baseline Consumption Comparison

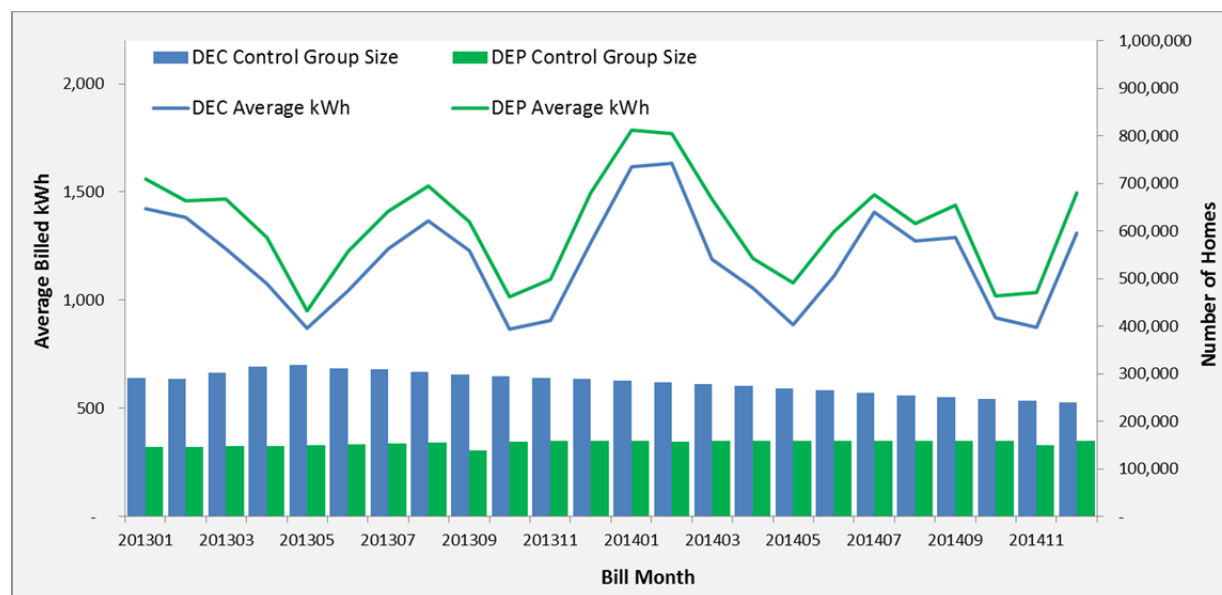


Table 5-10 provides the average annual control group consumption by year for DEC and DEP in addition to a two-year average. The ex-ante savings claim of 183.7 kWh per home represents a 1.29% reduction in consumption for DEC and a 1.14% reduction in consumption for DEP. HER studies generally reveal a percent reduction between 1% and 2%, so the Carolinas ex-ante savings claim appears relatively conservative.

Table 5-10: Average Annual Control Group Consumption by Jurisdiction

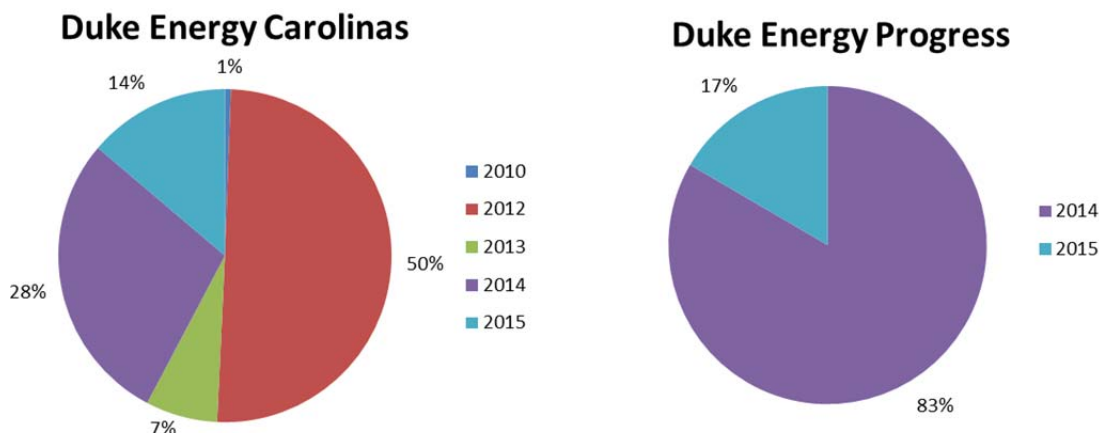
Year	DEC	DEP
2013	13,902	15,862
2014	14,569	16,445
Two Year Average	14,235	16,154

H.3 Duration of Exposure

While MyHER participants in DEP service territory have a higher average electric consumption, the MyHER program is more mature in DEC territory. Half of the MyHER treatment group in DEC territory has been receiving MyHER since fall 2012, while MyHER wasn't broadly rolled out

in DEP until December 2014. Figure 22 shows the shares of each jurisdiction's treatment group that began receiving MyHER in each year 2010-2015.

Figure 22: Distribution of MyHER Treatment Group by Year of First MyHER Mailer



Nexant's evaluation of MyHER impacts in DEO service territory found a clear upward trend in the magnitude of savings as the duration of exposure increased. This finding is consistent with most other multi-year evaluations of HER impacts across North America. Table 5-11 shows the average kWh impact for homes in the DEO treatment group that received MyHER consistently from beginning of 2012. Each year the kWh savings increase by more than 50 kWh over the previous year.

Table 5-11: Increasing Effect of MyHER over Time (MyHER DEO)

Year	Average Observed kWh Savings per Home	HDD (Base 65 F)	CDD (Base 65 F)
2012	110	4,199	1,439
2013	168	5,029	1,150
2014	220	5,438	1,077

Nexant's analysis to date of MyHER impacts in DEI territory also supports the correlation between duration of exposure and average kWh per home. The homes in DEI who have been receiving MyHER since 2012 produce average annual⁴ impacts over 200 kWh per home, while the large group of homes assigned to MyHER in February 2014 averaged less than 150 kWh per home. If the expected relationship between duration of exposure and kWh impacts holds true in the Carolinas, we would expect to see a larger average treatment effect (on a % basis) in DEC territory than DEP.

H.4 Control Group Release

⁴ The DEI period of performance analyzed by Nexant is August 2014 through July 2015

The shares presented in Figure 22 were calculated *after* fairly large change in the MyHER group composition that occurred in the middle of the evaluation period of performance. In October 2015 approximately 72,000 homes in DEP and 147,000 homes in DEC were released from the MyHER control group to the treatment group and began receiving MyHER mailers⁵. While this control group release increases the number of homes receiving MyHER, it likely dilutes the average per home impact because the average duration of exposure of homes in the DEC and DEP treatment groups was reduced for November 2015 through April 2016. In both jurisdictions approximately 10% of the treatment group from November 2015 to April 2016 will consist of homes that are new to MyHER and should be expected to have modest savings levels as they will be in the first six months of treatment.

H.5 Previous Evaluation

Nexant also reviewed the previous impact evaluation reports and found no methodological issues that would compromise the findings. However, there are some important programmatic changes that limit the applicability of findings on a forward looking basis.

- 1) The previous DEP evaluation conducted by Navigant (*Program Year 2 (2012-2013) EM&V Report for the Residential Energy Efficiency Benchmarking Program*) found an average per home annual impact of 260 kWh. During the period analyzed the program was much smaller than its current scope in DEP at approximately 60,000 treatment group homes. The HER vendor for this period was also different with Opower implementing the program rather than Tendril. This evaluation found a difference in savings for the two waves of homes consistent with previous discussions about duration of exposure. The Initial Wave of homes produced average savings of 1.63% (280 kWh) while the Refill Wave that began treatment 18 months later produced average savings of 1.22% (172 kWh).
- 2) The previous DEC evaluation conducted by TecMarket Works and Integral Analytics (*Process and Impact Evaluation of the My Home Energy Report (MyHER) Program in the Carolina System*) was the basis of the 183.7 kWh per home ex-ante savings. This analysis examined the impacts from June 2012 (SC) and October 2012 (NC) to August 2013 and included approximately 750,000 treatment group homes. The homes analyzed in this previous evaluation represent approximately half of the total DEC treatment group homes Nexant will be analyzing so it is a good indicator of expected impacts. These 750,000 homes will have been exposed to the program for several additional years so their average impacts would be expected to increase. DEC treatment groups that have been added since the previous evaluation will have a shorter duration of exposure and may offset the expected gains from Legacy homes.

Both evaluations utilized a linear fixed effects regression (LFER) model to estimate the treatment effect using billed consumption data provided by Duke. Nexant reviewed the methodology and results presented in the two reports and found no methodological concerns

⁵ For the period May to October 2015, the share of homes that began receiving treatment in 2015 would be lower than what is presented in Figure 22

with the approach taken that would cast doubt on the resulting impact estimates. In both the cases, it is important to remember that the current program composition is very different from what was studied previously.

H.6 Randomization

In December 2014 the current DEP MyHER program was launched and the DEC MyHER program was expanded substantially. The kWh savings observed among these waves of homes assigned to MyHER will be critical to the results of the upcoming evaluation as they make up approximately 30% of the current DEC treatment group and over 80% of the current DEP treatment group. Fortunately a large number of homes were randomly assigned to the control group at the same time.

Figure 23 compares the usage of the DEC treatment and control groups added in December 2014 for each month in 2014 (before anyone received a MyHER report). Figure 24 provides a similar comparison for DEP homes assigned to MyHER in December 2014. The dark blue box extends from the 25th percentile to the 75th percentile and the small vertical line is the median. Both plots show that electric consumption patterns of the treatment and control groups are very well aligned. This high quality randomization will minimize the degree to which the regression analysis will need to control for pre-existing differences and produce highly defensible impact estimates.

Figure 23: Comparison of 2014 Usage for December 2014 DEC Assignments

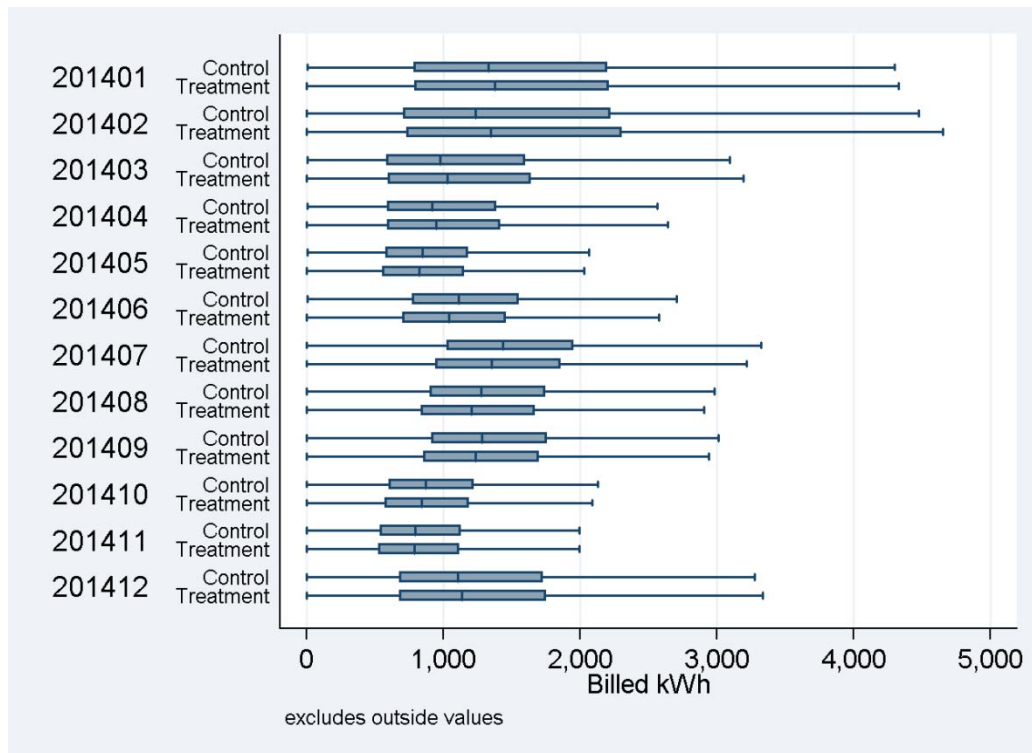


Figure 24: Comparison of 2014 Usage for December 2014 DEP Assignments

